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Assessment of Fallout in the United States from the Atmospheric Nuclear Test by the People's Republic of China on September 17, 1977

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16. ABSTRACT

The People's Republic of China conducted an atmospheric nuclear weapons test over the Lop Nor testing area in Southwest China at 3:00 a.m., EDT, on September 17, 1977. Based on past experience, EPA expected that radioactive fallout from this event might be measureable but not excessive in the United States. For several weeks following this event, EOA monitored for fallut by fully activating the Environmental Radiation Ambient Monitoring System (ERAMS). Fallut radionuclides on airborne particulates, in precipitation, and in cow's milk were detectable at many sampling locations thorughout the United States. Maximum individual doses for all nuclides detected in air and milk following the event were calculated for six organs (bone, liver, thyroid, kidney, lung, and GI-LLI), total body, and skin. The highest individual dose was for the ^{131}I-milk-thyroid pathway. This thyroid dose was a factor of 4 higher than the maximum lung and bone doses and about a factor of 20 higher than the other doses. U.S. population doses of 150,200 man-rem to the lung, 127,700 man-rem to the thyroid, and 107,600 man-rem to the bone were calculated. The population doses calculated for the other organs and for total body and skin were from one-fourth to one tenth of the above doses. The calculated total body population dose was 17,200 man-rem.

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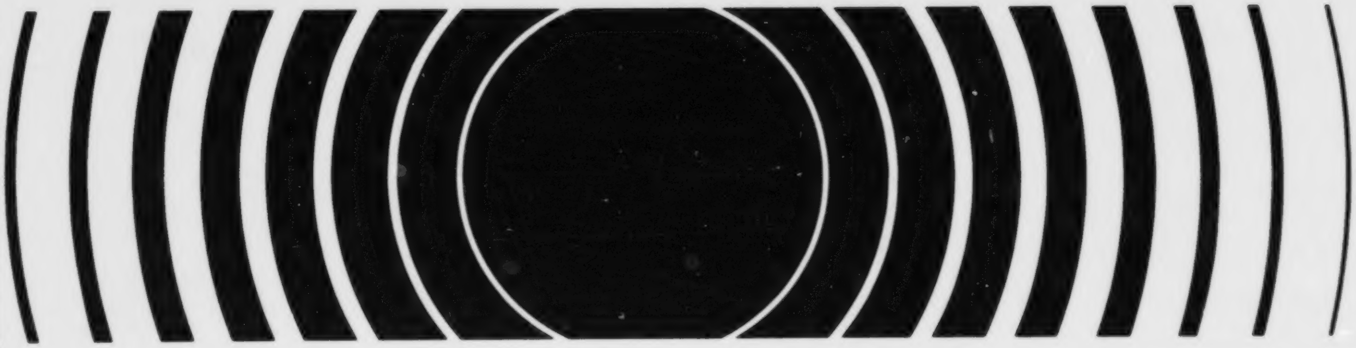

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ASSESSMENT OF FALLOUT IN THE UNITED STATES FROM THE ATMOSPHERIC NUCLEAR TEST BY THE PEOPLE'S REPUBLIC OF CHINA ON SEPTEMBER 17, 1977

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July 1979

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FOREWORD

The Office of Radiation Programs (ORP) of the U.S. Environmental Protection Agency (EPA) has a primary responsibility to establish radiation protection guidance and to interpret existing guides for Federal agencies. This responsibility was transferred to the Administrator of EPA from the Federal Radiation Council which was abolished by Reorganization Plan No. 3 of 1970. One of ORP's mandates in carrying out this reponsibility is to monitor and assess the impact on public health and the environment of radiation from all sources in the United States, both ionizing and nonionizing. Therefore, ORP has initiated a radiological dose assessment program to determine the status of radiation data nationwide, to analyze these data in terms of individual and population doses, and to provide guidance for improving radiation data. In addition, this program will provide information to guide the direction of ORP by the analysis of radiation trends, identification of radiation problems, and support for establishing radiation protection guidance.

As a part of this program, ORP operates a system for monitoring levels of radioactivity in the environment. This system is called the Environmental Radiation Ambient Monitoring System (ERAMS) and is operated by EPA's Eastern Environmental Radiation Facility in Montgomery, Alabama. This monitoring program is designed to provide long-term radioactivity assessment of trends and seasonal changes and short-term early warning to establish the need for emergency abatement actions or contingency sampling operations. Sampling media included in this program are air particulates, precipitation, surface water, drinking water and pasteurized milk.

Following the atmospheric nuclear weapons test by the People's Republic of China at 3:00 a.m., EDT, on September 17, 1977, the ERAMS network was fully activated and frequent samples of air particulates, precipitation, and pasteurized milk were collected for several weeks after each event. Individual and population doses for the United States were calculated using the levels of radioactivity measured in these samples. Based on the calculated doses, health effects to the population of the United States were estimated. This report is a summary of EPA's assessment regarding the radiation doses and potential health effects which may be attributed to radioactive fallout from these nuclear weapons tests.

Gordon Burley, Acting Director
Office of Radiation Programs

PREFACE

The Eastern Environmental Radiation Facility (EERF) participates in the identification of solutions to problem areas as defined by the Office of Radiation Programs. The Facility provides analytical capability for evaluation and assessment of radiation sources through environmental studies and surveillance and analysis. The EERF provides technical assistance to state and local health departments in their radiological health programs and provides special analytical support for Environmental Protection Agency Regional Offices and other federal government agencies as requested.

This report presents EERF's assessment of the public health impact of fallout from the atmospheric nuclear test by the People's Republic of China on September 17, 1977.

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ABSTRACT

The People's Republic of China conducted an atmospheric nuclear weapons test over the Lop Nor testing area in Southwest China at 3:00 a.m., EDT, on September 17, 1977. Based on past experience, EPA expected that radioactive fallout from this event might be measureable but not excessive in the United States. For several weeks following this event, EPA monitored for fallout by fully activating the Environmental Radiation Ambient Monitoring System (ERAMS). Fallout radionuclides on airborne particulates, in precipitation, and in cow's milk were detectable at many sampling locations throughout the United States.

Maximum individual doses for all nuclides detected in air and milk following the event were calculated for six organs (bone, liver, thyroid, kidney, lung, and GI-LLI), total body, and skin. The highest individual dose was for the ^{131}I-milk-thyroid pathway. This thyroid dose was a factor of 4 higher than the maximum lung and bone doses and about a factor of 20 higher than the other doses. U.S. population doses of 150,200 man-rem to the lung, 127,700 man-rem to the thyroid, and 107,600 man-rem to the bone were calculated. The population doses calculated for the other organs and for total body and skin were from one-fourth to one-tenth of the above doses. The calculated total body population dose was 17,200 man-rem.

EPA has used the calculated population doses and dose-to-risk conversion factors to estimate excess somatic effects and genetic effects in the U.S. population because of this test. It was estimated that about 17 cancers and about 10 deaths might occur as somatic effects during the next 45 years as a result of these population doses. Across all succeeding generations of the U.S. population it is estimated that about 3 serious genetic effects might occur due to this test. These numbers of potential somatic health effects and genetic effects for the U.S. population are small and will be undetectable when compared to the estimated 16,500,000 deaths that might occur from other causes of cancer and the estimated 12,900,000 serious genetic effects that might occur in the U.S. over the next 45-50 years.

1.0 INTRODUCTION

1.1 Description of Fallout Incidents

The People's Republic of China detonated a nuclear device in the atmosphere over the Lop Nor testing area in Southwest China on September 17, 1977. The device was rated as a low yield type with an explosive power equivalent to 20-200 thousand tons of TNT.

Since the detonation was above ground, it was expected that radioactive materials would be injected into the atmosphere. The prevailing air currents over China move in an easterly direction. Therefore, within 4 to 7 days these airborne radioactive materials would be expected to arrive over the North American Continent. The fastest moving of these air currents of initial interest usually move at altitudes of 20 to 40 thousand feet. Normally, the materials carried by these air currents pass over the United States and Canada within 2 to 4 days after arrival at the west coast. The rest of the radioactive materials usually remain at the higher altitudes until slowly dropping down to the earth's surface as fallout over a period of several months or years.

The Environmental Protection Agency's experience, and that of its predecessor organizations, with atmospheric nuclear testing by the People's Republic of China (20 tests since October 1964) indicated that radioactive fallout levels are generally quite low in the United States. However, EPA was prepared to monitor for any fallout that might occur, although no significant radioactivity levels were expected.

1.2 Concerns for Fallout

Airborne radioactive materials produced by atmospheric nuclear weapons testing can cause radioactive exposure to people in several ways. The primary concern occurs when the radioactive materials come down from the atmosphere as fallout. Then people may be exposed by inhaling radioactive dust particles that can deposit in the lung or dissolve and move through the bloodstream to various organs of the body. People may also be exposed by ingesting foods containing fallout materials. Milk is the main food of concern because radioactive depositions on grass can be transferred into cow's milk. Fallout of dry materials or, more significantly, rainout of radioactive materials could deposit on large areas of land, including pastures for dairy cattle. Cows consume large quantities of grass, and some of the radioactive materials that may be on this grass are transferred within a day or two to the cow's milk. Times involved in milk production, transport, processing and bottling are such that normally several days would be required for any such potential contamination to reach pasteurized milk that is retailed to consumers.

1.3 EPA Responsibilities

EPA is responsible through its Office of Radiation Programs, for evaluating public exposure to all sources of radiation, and for issuing guidance to control these exposures or to set appropriate exposure standards. Inherent in this responsibility is the need to determine the impact of radiation doses from radioactive fallout. To assess the radiation doses from radionuclides in the general ambient environment, EPA maintains a monitoring program known as the Environmental Radiation Ambient Monitoring System (ERAMS). This system was alerted for special radiation measurements prior to and during the times of anticipated fallout from the September 17, 1977, nuclear test. ERAMS is described in detail later in this report.

In addition, EPA is responsibile for notifying State agencies of the possibility of radioactive fallout. EPA also keeps State agencies informed on the national and regional radiological picture and advises them on surveillance or protective actions that they may pursue.

EPA collects information from its own monitoring system, from State monitoring programs, and from other Federal agencies to assess the national radiological situation. This information is then relayed to the public by means of press releases during the time of potential fallout. Other Federal agencies are also informed of the situation as appropriate.

1.4 Purpose and Scope of This Report

This report represents EPA's assessment of radiation doses due to radioactive fallout from the atmospheric nuclear test of September 17, 1977.

This assessment is based upon data from EPA's national monitoring program for fallout and focuses on the potential for radiation exposures due to radionuclides in pasteurized milk and due to air inhalation and air submersion.

Detailed data on EPA's monitoring measurements are included in Tables 6, 7, 8, and 13 in the April 1978 issue of Environmental Radiation Data (EPA78). These data were used to assess individual and population doses as discussed in Section 7. The assessment of population health effects is given in Section 8. Each of these sections briefly outlines the assessment approach and modelling parameters. The interpretation of dose and health effects is presented in the discussion in Section 9.

Specifically, this report presents information on the following items:

(a) description of fallout incident
(b) movement of contaminated air masses
(c) EPA's general monitoring program
(d) EPA's specific fallout monitoring efforts
(e) EPA's monitoring results
(f) population dose assessment
(g) potential health effects
(h) interpretation of dose and health effects and conclusions

2.0 EPA MONITORING PROGRAM

2.1 Environmental Radiation Ambient Monitoring System (ERAMS)

Continuing surveillance of radioactivity levels in the United States is maintained through EPA's Environmental Radiation Ambient Monitoring System (ERAMS). This system was formed in July 1973 from the consolidation and redirection of separate monitoring networks formerly operated by the U.S. Public Health Service prior to EPA's formation. These previous monitoring networks had been oriented primarily to measurements of fallout levels. They were modified by changing collection and analysis frequencies and sampling locations and by increasing the analyses for some specific radionuclides. The emphasis of the current system is toward identifying trends in the accumulation of long-lived radionuclides in the environment. However, ERAMS, by design, is flexible and can provide short-term assessments of large scale events such as fallout.

ERAMS normally involves several thousand individual analyses per year on samples of air particulates, precipitation, milk, and surface and drinking water. Samples are collected at about 150 locations in the United States and its territories, mainly by State and local health agencies. These samples are forwarded to ORP's Eastern Environmental Radiation Facility (EERF) in Montgomery, Alabama for analyses. ERAMS data are tabluated quarterly and issued to the groups involved in the program.*

2.2 Airborne Particulates and Precipitation Sampling

The air monitoring program of ERAMS consists of 22 continuously operating stations and 46 standby stations located throughout the United States, Puerto Rico, and the Canal Zone (Fig. 1). At the continuously operating stations, airborne particulates are collected continuously on filters which are changed twice weekly. Aliquots of precipitation are also collected twice weekly and are submitted to EERF for analysis with the air particulate samples. When the possibility of fallout occurs, the 46 additional standby stations are alerted and daily sampling is started at all stations. The air particulate samples are important for estimating the potential population dose from inhalation of fallout materials. Precipitation samples are collected to monitor rainout of radioactive materials that may contaminate pasture and crop lands.

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*ERAMS data are published quarterly in the EPA publication Environmental Radiation Data. A summary analysis of ERAMS data will be presented in each year's publication of EPA's Radiological Quality of the Environment in the United States. This publication is available from the Office of Radiation Programs, USEPA, 401 M Street, S.W., Washington, D.C. 20460. Previously, ERAMS data were published monthly in Radiation Data and Reports. This publication was terminated in December 1974.

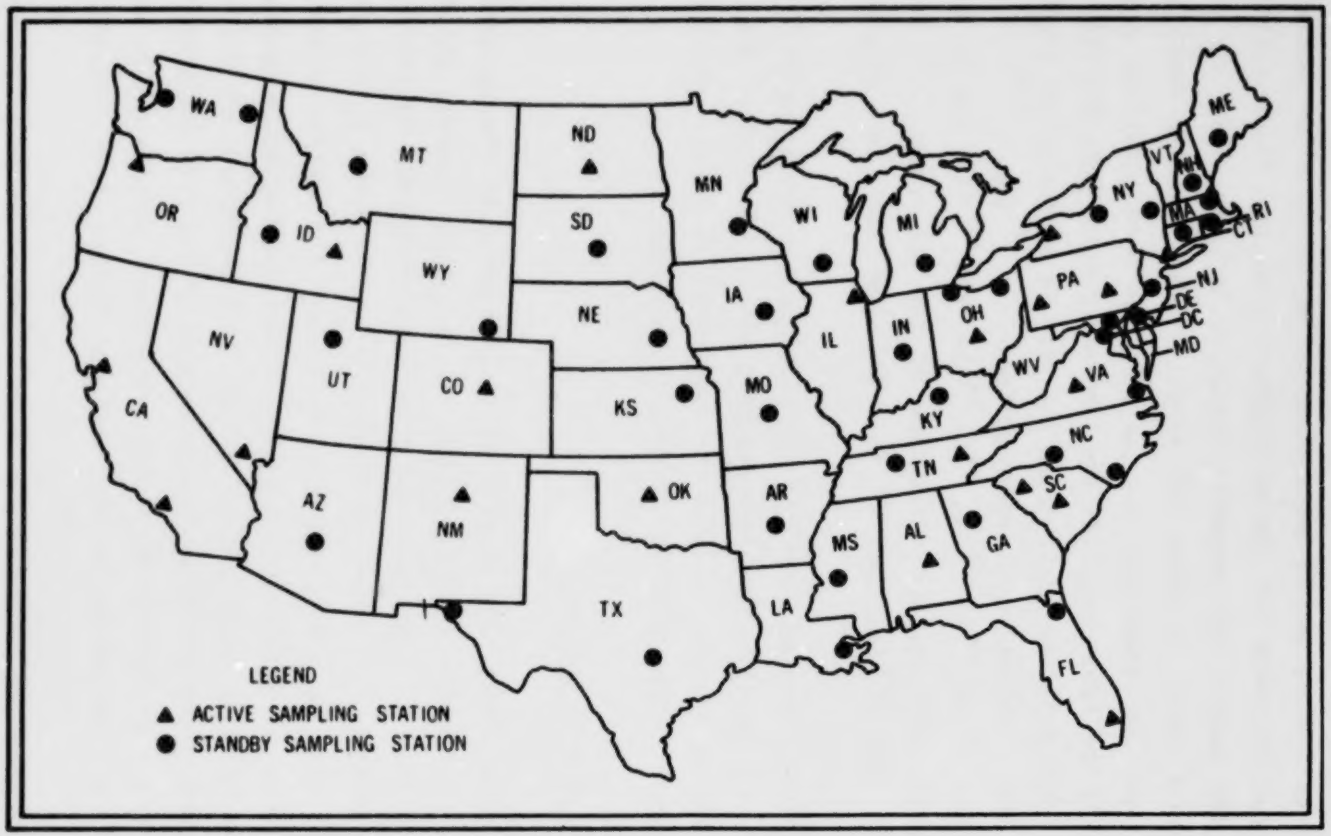
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Fig. 1. Environmental Radiation Ambient Monitoring System (ERAMS) airborne particulates and precipitation sampling locations

High efficiency, charcoal impregnated, cellulose filters are used for air particulate collection. Field gross beta measurements are made with a G-M survey meter at 5 hours and 29 hours after collection to allow subtraction of naturally occurring radon and thoron daughter products. Field estimates are reported to the Eastern Environmental Radiation Facility (EERF) via telephone if the activity level is twice the normal reading for the sampling area.

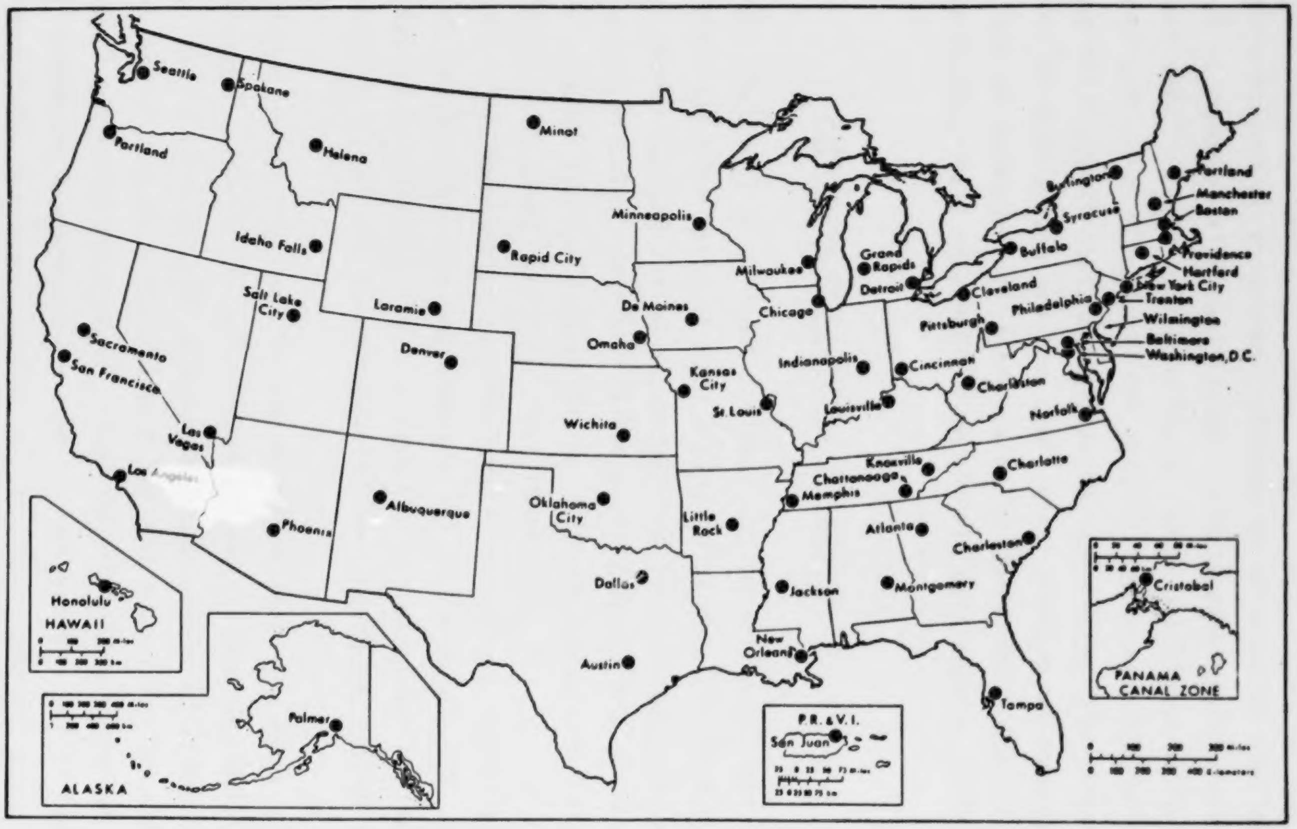
The filters are then sent to the EERF for more sensitive gross beta measurements in the laboratory. If the laboratory gross beta activity exceeds 1 pCi/m^3, a sodium iodide (NaI) gamma analysis is performed to identify and quantify the following radionuclides: ^{144}Ce, ^{131}I, ^{106}Ru, ^{137}Cs, ^{95}Zr-Nb, ^{232}Th, ^{65}Zn, ^{60}Co, ^{40}K, ^{140}Ba, and ^{214}Bi. Due to the similarity of gamma energies and resolution of the NaI crystal, ^{141}Ce may be present with the ^{144}Ce, and ^{103}Ru, and ^{7}Be may be reported with ^{106}Ru.

Precipitation samples from the 22 continuously operating stations are sent directly to the EERF for gamma analysis whereas aliquots of the precipitation from the 46 standby stations are evaporated to dryness and gross beta field estimates are made prior to shipment to the EERF.

2.3 Pasteurized Milk Sampling

The milk monitoring program of ERAMS is a cooperative program between the Environmental Protection Agency's Office of Radiation Programs and the Milk Sanitation Section of the Food and Drug Administration. Pasteurized milk samples are normally collected the first week of the month by FDA representatives at 65 sampling sites, one or more of which are located in each State, Puerto Rico, and the Canal Zone (Fig. 2). These are composite samples based on the volume of milk sold by the various milk processors in the sampling station area and represent more than 80 percent of the milk consumed in major population centers of the United States. Additional samples may be collected upon request to respond to events such as fallout from nuclear weapons testing.

Gamma analyses are performed on the milk samples as soon as they arrive at the EERF and results for ^{131}I, ^{140}Ba, ^{137}Cs, and ^{40}K are available within hours after receipt. If samples have ^{131}I and ^{140}Ba activity levels greater than 10 pCi/liter or abnormally high ^{137}Cs values, then ^{89}Sr, ^{90}Sr analyses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HAWAII
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Tampa
Palmer
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San Juan
Cristobal
PANAMA CANAL ZONE

Fig. 2. ERAMS pasteurized milk component sampling locations

are performed. The radiostrontium data are usually available within two weeks after sample receipt at EERF.

The radionuclides ^{131}I, ^{140}Ba, ^{137}Cs, ^{90}Sr, and ^{89}Sr have been shown in previous fallout episodes to be sensitve indicators of fission product radioactivity from nuclear detonations. Pasteurized milk consumption is important in determining population dose resulting from radionuclides that rapidly transfer from the environment through food chains to man. The food chain of interest begins with particulate deposition on grass forage. The grass forage than is consumed by grazing dairy cows, and the metabolized radionuclides in cows are rapidly transferred to milk, which is processed by the dairy and ready for public consumption within one to four days after deposition.

3.0 MOVEMENT OF CONTAMINATED AIR MASSES

Since the detonation by the People's Republic of China was above ground, large amounts of radioactive materials were injected into the atmosphere and carried in an easterly direction toward the United States. These radioactive materials, which are normally invisible to the eye, typically begin dispersing laterally and vertically depending on particle sizes and shapes, temperature, and wind velocity. At each particular altitude, there is a forward region where contaminated air begins mixing with uncontaminated air. This area is called the "leading edge" of the contaminated air mass and can sometimes be detected by instrument-carrying aircraft. The movement of contaminated air masses at various altitudes can be predicted on the basis of meteorological data.

Fig. 3 shows the initial trajectory of the radioactive debris from the Chinese nuclear detonation on September 17, 1977. This detonation was a relatively low-yield explosion, consequently, the majority of the radioactive material did not penetrate the stratosphere but remained in the troposphere (i.e., below approximately 35,000 ft.). It took approximately 4 days for the leading edge of the radioactive air mass in the upper troposphere (30,000 ft. level) to reach the west coast of the United States and about 2 more days to cross the United States (see Fig. 4).

The leading edge of the contaminated air mass reached the Pacific coast of Alaska and Canada late on September 20 and moved southward over the west

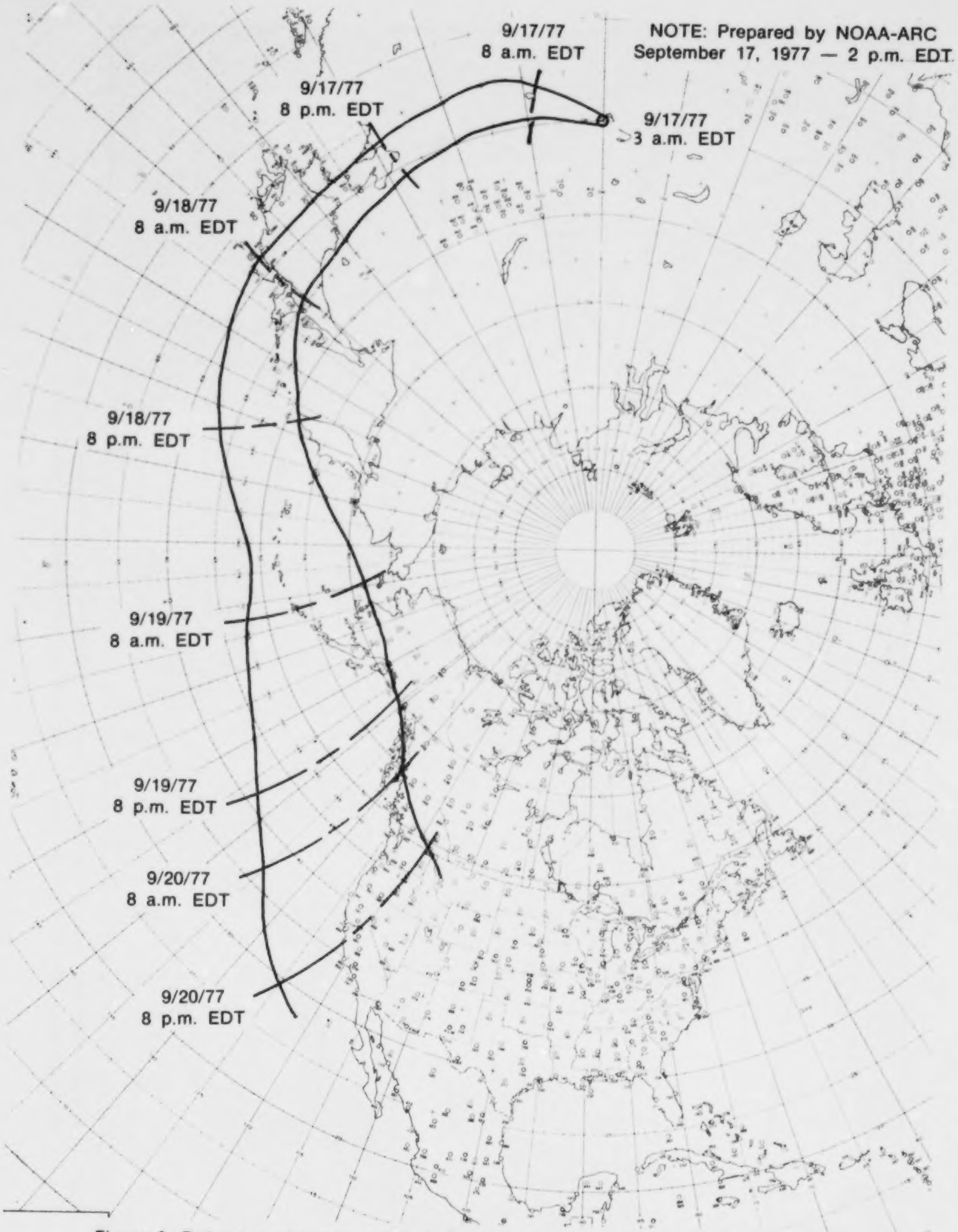

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Figure 3. Estimated path from China to the United States of debris at the 300 millibar level (approximately 30,000 ft.) from the Chinese nuclear detonation of September 17, 1977.

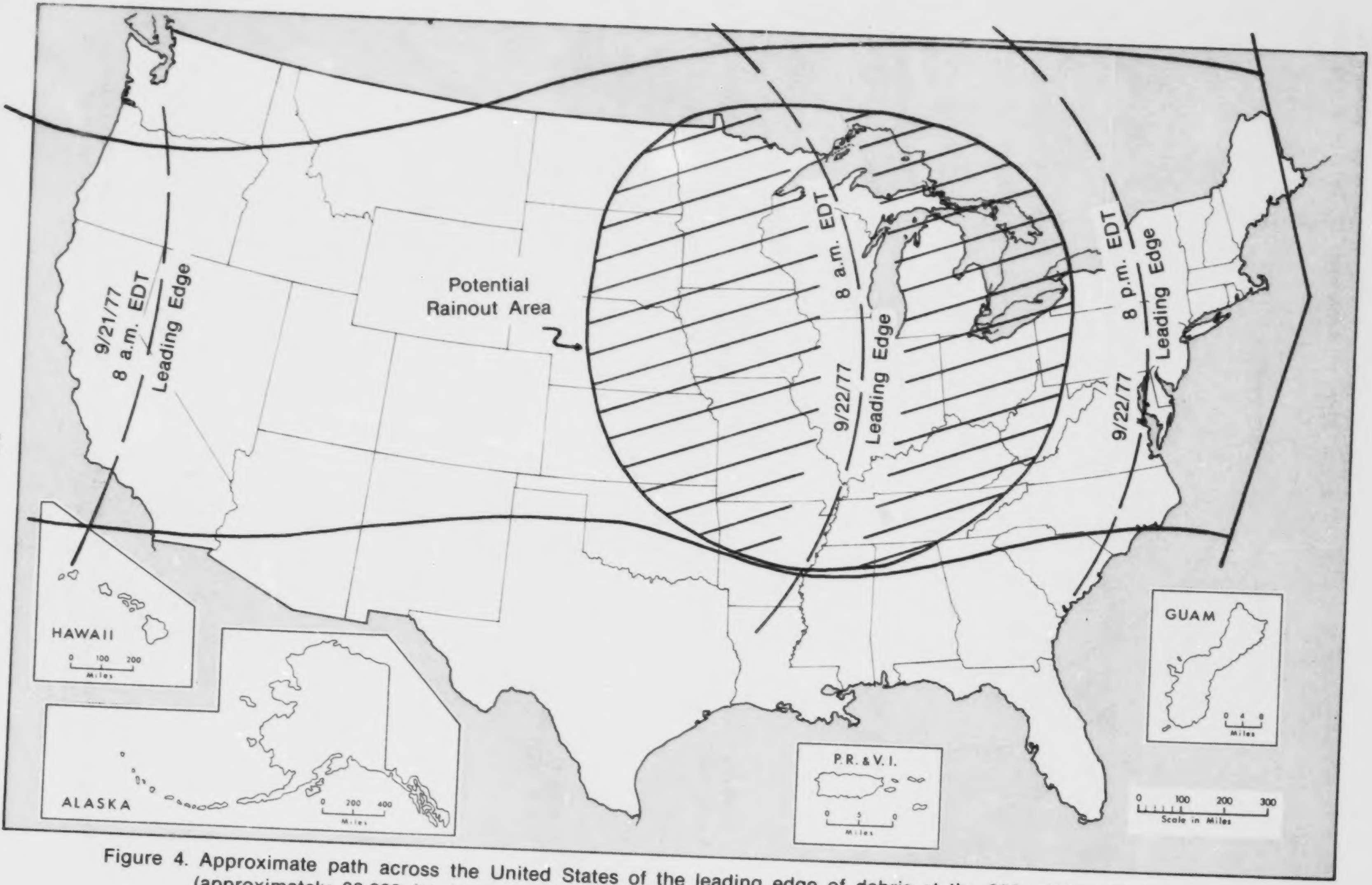
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Figure 4. Approximate path across the United States of the leading edge of debris at the 300 millibar level (approximately 30,000 ft.) from the Chinese nuclear detonation of September 17, 1977.

coast of the United States. It then moved rapidly across to the Great Lakes by early morning of September 22 and had reached the east coast late that same day. Some rainout was detected in a precipitation sample collected September 21 at Anchorage, Alaska, but it was September 26 before measureable rainout was detected in other areas of the U.S.

Trailing debris at a lower altitude crossed the Pacific more slowly and was detected on September 25-29 at Honolulu, HI; Denver, CO; Las Vegas, NV; Cheyenne, WY; Salt Lake City, UT; and Sante Fe, NM. This slower moving debris had reached Florida by October 2nd and 3rd. Normally, a radioactive air mass will circle the world after the first pass over the United States and may still be detectable on its second pass. However, detection of the second pass of the main cloud was difficult to determine in this case due to the slow passage of the trailing debris from the first pass. After the second pass, a contaminated air mass usually becomes very diffuse and radioactivity is decayed to the point where further passes can not be positively detected.

4.0 EPA FALLOUT MONITORING RESPONSES

The Department of Energy (DOE) on Saturday, September 17, 1977, informed EPA of the nuclear detonation and also made a public announcement of the test. The DOE has the responsibility in the Federal government of announcing both domestic and foreign nuclear detonations along with other pertinent information about the detonations.

On September 17, 1977, the National Oceanic and Atmospheric Administration (NOAA) made the first preliminary prediction of the trajectory of the leading edge of the contaminated air mass. These predictions were revised daily as more information became available. The NOAA has the Federal responsibility for predicting the airborne trajectory of the contaminated air masses and the time of potential radioactive fallout across the United States.

Based on the above information, EPA, on September 17, began notifying the States and the ERAMS air particulate and precipitation sampling stations to activate the standby portion of the network and to increase the sampling frequency for the regular sampling stations. The entire network was in full operation by Tuesday, September 20.

Based on an anticipated increase in fallout radioactivity in pasteurized milk, EPA requested that the Food and Drug Administration (FDA) notify all sampling stations to collect additional milk samples. Normally, samples are collected from all stations the first of each month, but, beginning September 26, weekly samples were collected at each station.

The EPA monitored the concentrations of radioactivity in air particulates and precipitation until October 14 and continued weekly collections of pasteurized milk samples into November 1977. At these times, the concentrations of radioactivity in air and milk, respectively, were essentially normal. Overall, approximately 1100 air particulate samples, 100 precipitation samples, and 500 milk samples were collected for a total of over 3,000 individual measurements. Information was issued through 16 news releases from September 18 to November 10. These news releases indicated that at no time did EPA evaluate the fallout situation as warranting any protective actions on a broad basis, and no such actions were suggested.

5.0 AIR PARTICULATE AND PRECIPITATION MEASUREMENTS

Gross beta field estimates are performed on all air particulate samples in the field at 5 and 29 hours after collection, and laboratory measurements are made usually within 3 to 5 days following collection, after the decay of naturally occurring short-lived radon and thoron daughter products. These measurements are used as screening mechanisms to determine the need for additional specific isotopic analyses. Gross beta measurements alone are not sufficient for dose estimates that require data on concentrations of individual isotopes. However, the beta measurements are useful for determining trends and patterns of fallout in the United States.

The geographical distribution of gross beta radioactivity on airborne particulates was plotted on the basis of laboratory measurements for each day between September 21 and October 2 and for October 14. Seven of these distribution plots which show the trend in the level of fallout radioactivity in the environment over this period are included as Figs. 5 - 11. The contours denoting separation of radioactivity levels were arrived at by mathematical interpolation. Variations within the two lower levels are normally seen as

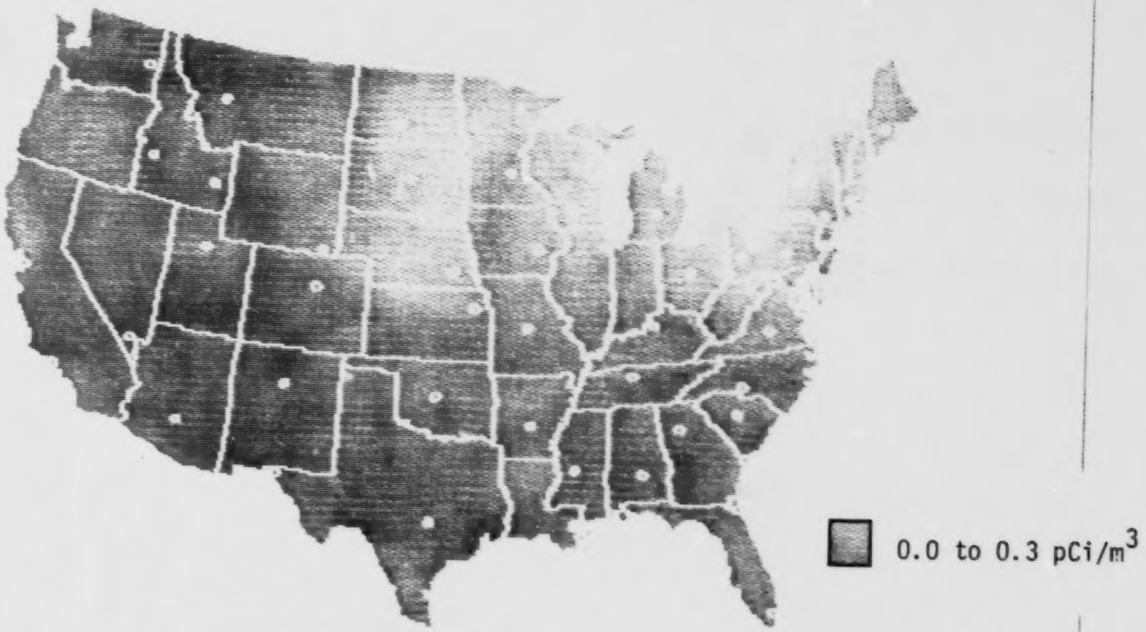

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Fig. 5. Distribution of gross beta in airborne particulates (pCi/m^3). Laboratory measurements for September 22, 1977.

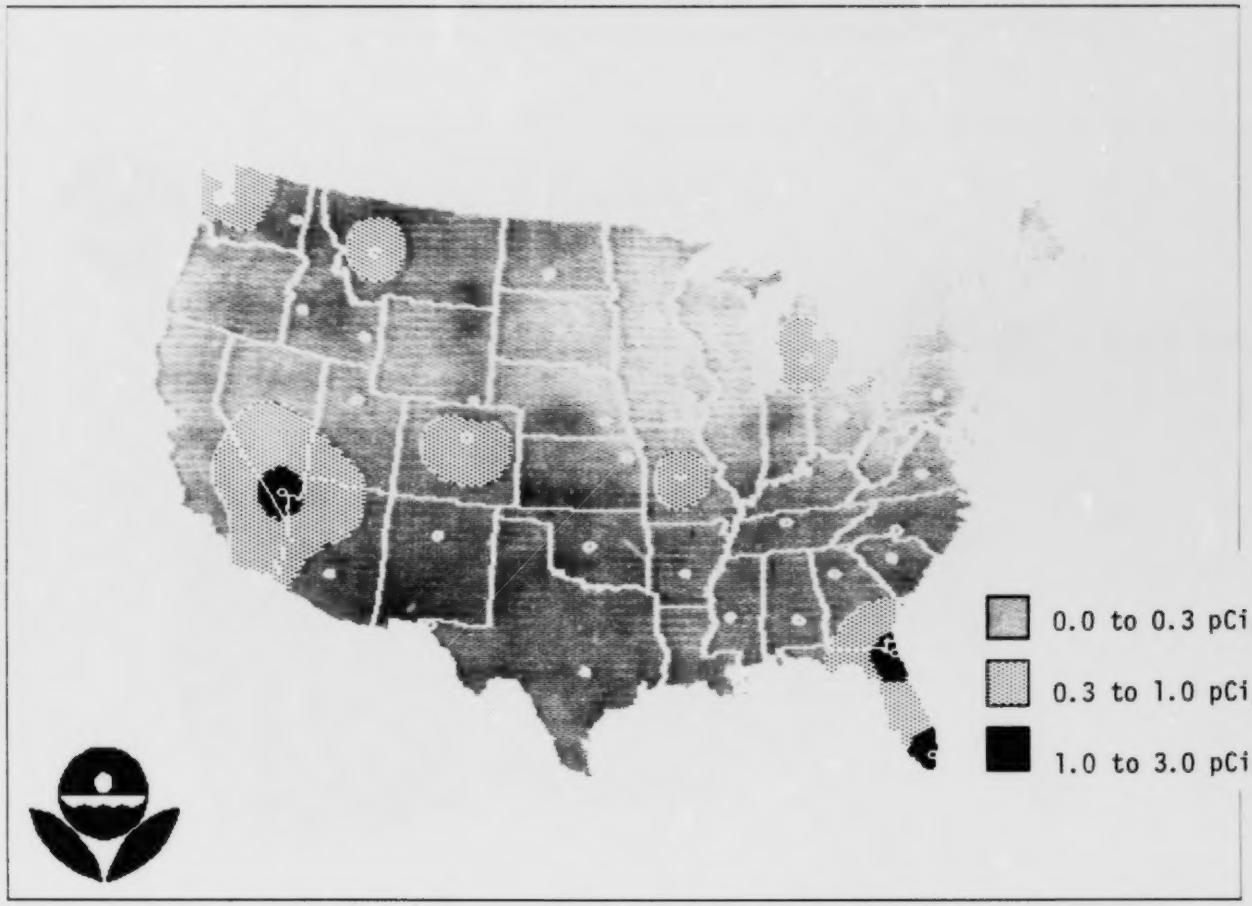
0.0 to 0.3 pCi/m3
0.3 to 1.0 pCi/m3
1.0 to 3.0 pCi/m3

Fig. 6. Distribution of gross beta in airborne particulates (pCi/m^3). Laboratory measurements for September 24, 1977.

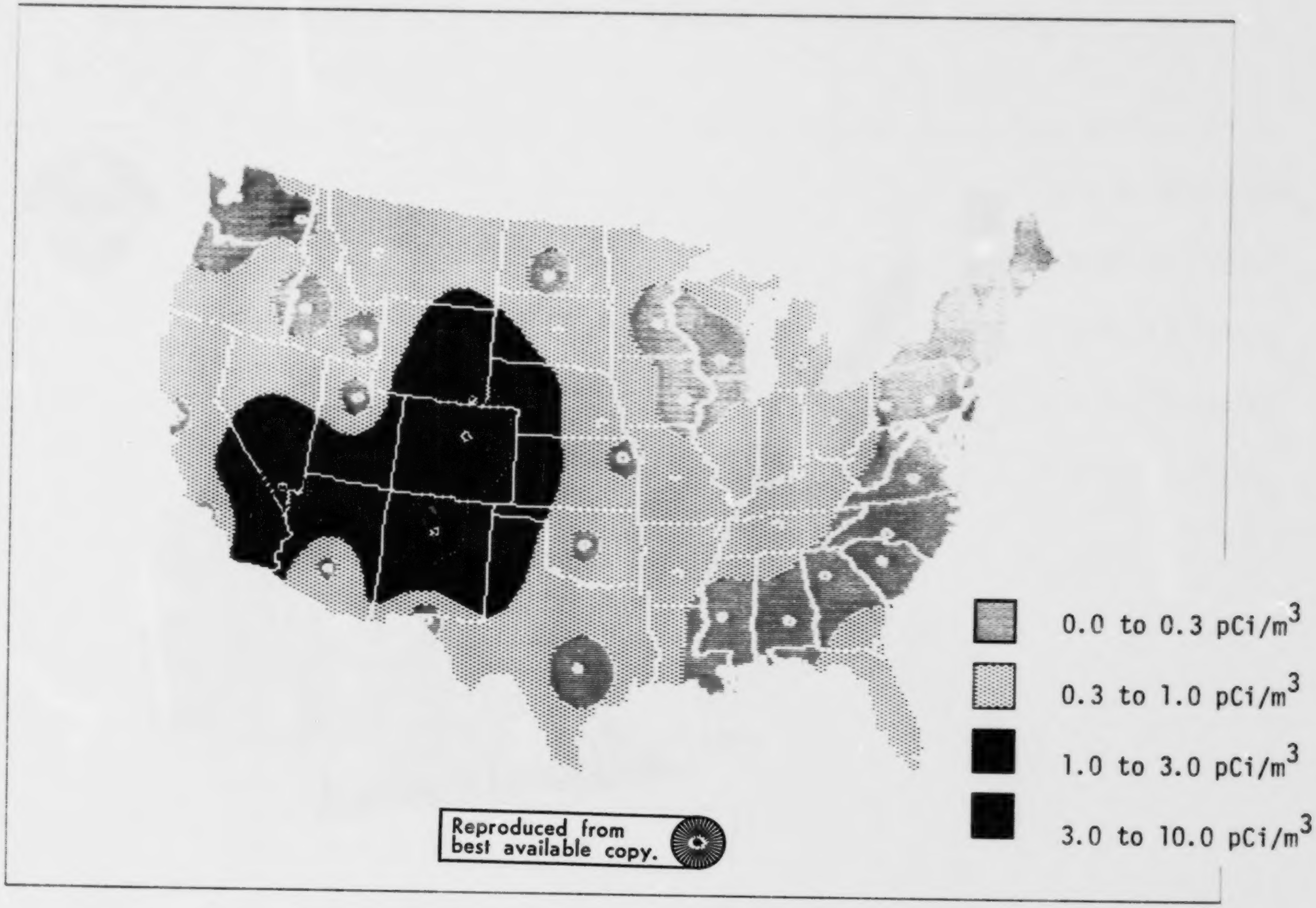
0.0 to 0.3 pCi/m3
0.3 to 1.0 pCi/m3
1.0 to 3.0 pCi/m3
3.0 to 10.0 pCi/m3

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Fig. 7. Distribution of gross beta in airborne particulates (pCi/m^3). Laboratory measurements for September 25, 1977.

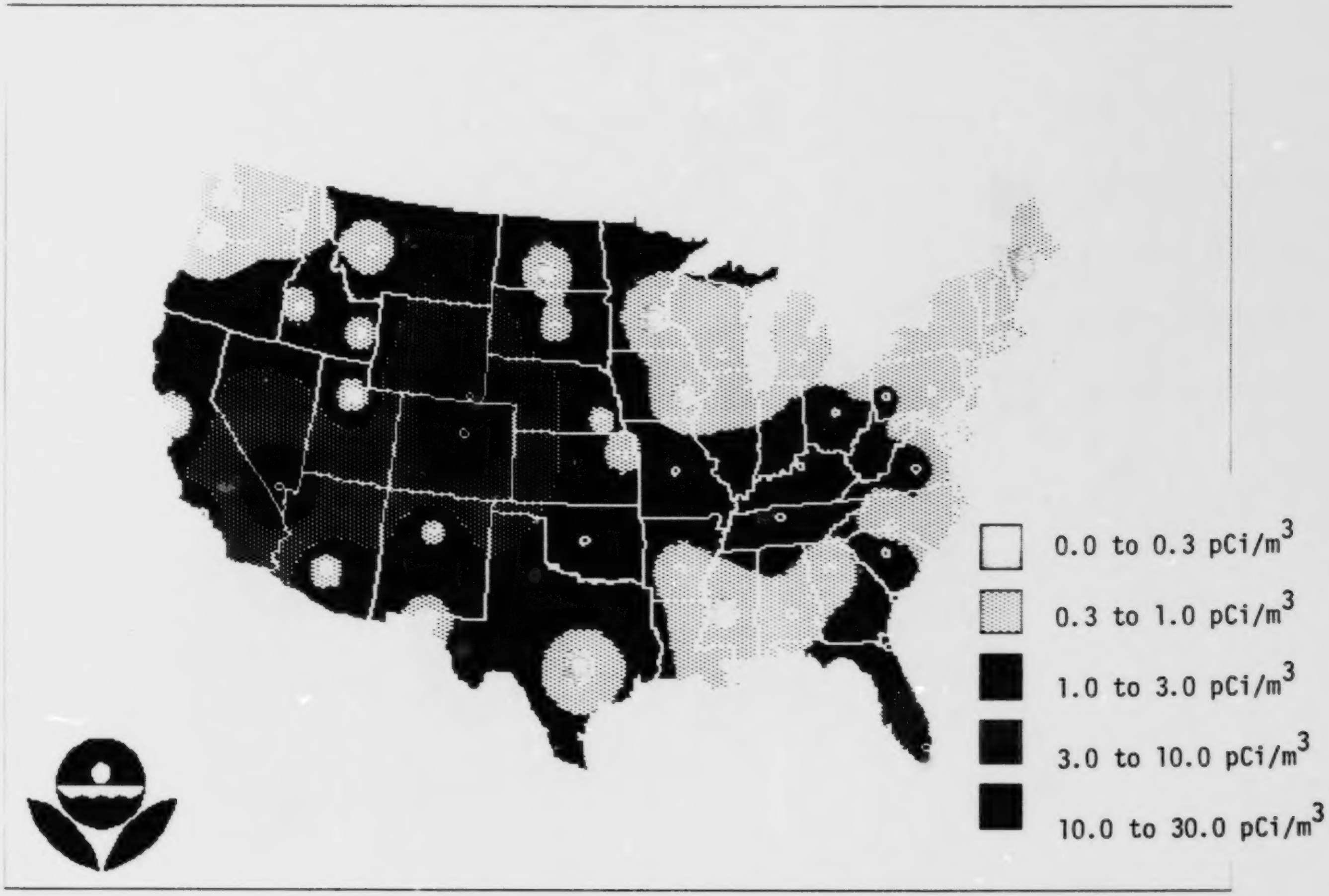
0.0 to 0.3 pCi/m3
0.3 to 1.0 pCi/m3
1.0 to 3.0 pCi/m3
3.0 to 10.0 pCi/m3
10.0 to 30.0 pCi/m3

Fig. 8. Distribution of gross beta in airborne particulates (pCi/m^3). Laboratory measurements for September 27, 1977.

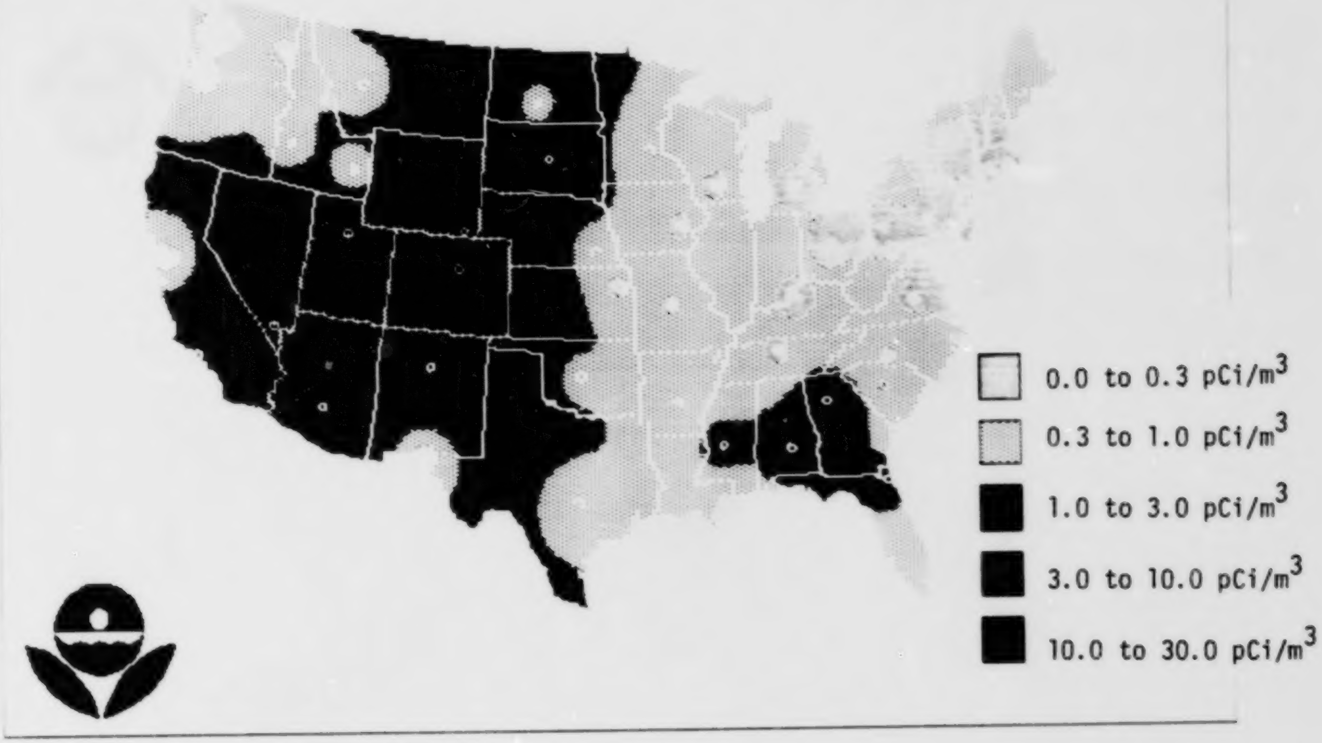
☐ 0.0 to 0.3 pCi/m^3
▨ 0.3 to 1.0 pCi/m^3
■ 1.0 to 3.0 pCi/m^3
■ 3.0 to 10.0 pCi/m^3
■ 10.0 to 30.0 pCi/m^3

Fig. 9. Distribution of gross beta in airborne particulates (pCi/m^3). Laboratory measurements for September 29, 1977.

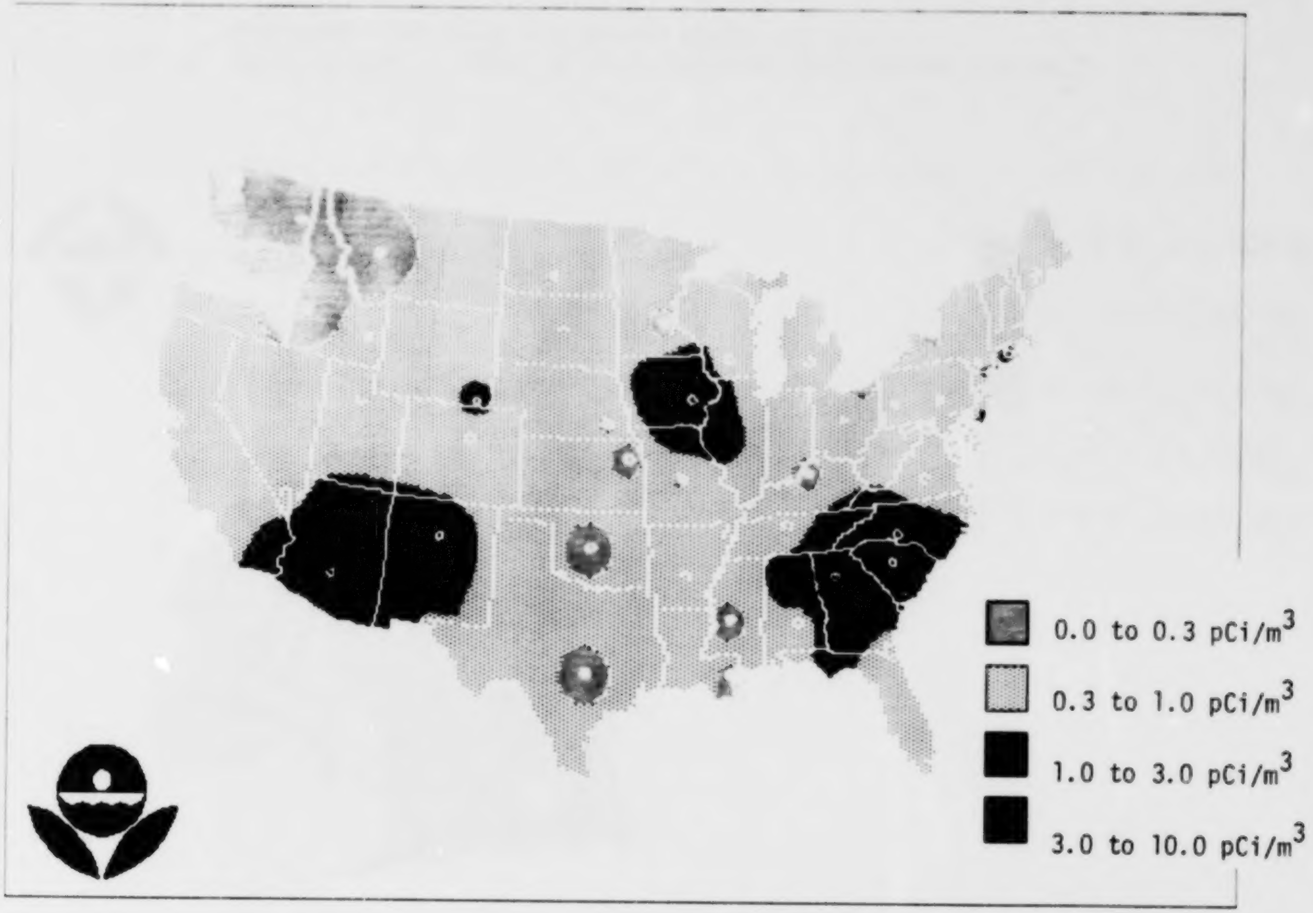
0.0 to 0.3 pCi/m3
0.3 to 1.0 pCi/m3
1.0 to 3.0 pCi/m3
3.0 to 10.0 pCi/m3

Fig. 10. Distribution of gross beta in airborne particulates (pCi/m^3). Laboratory measurements for October 2, 1977.

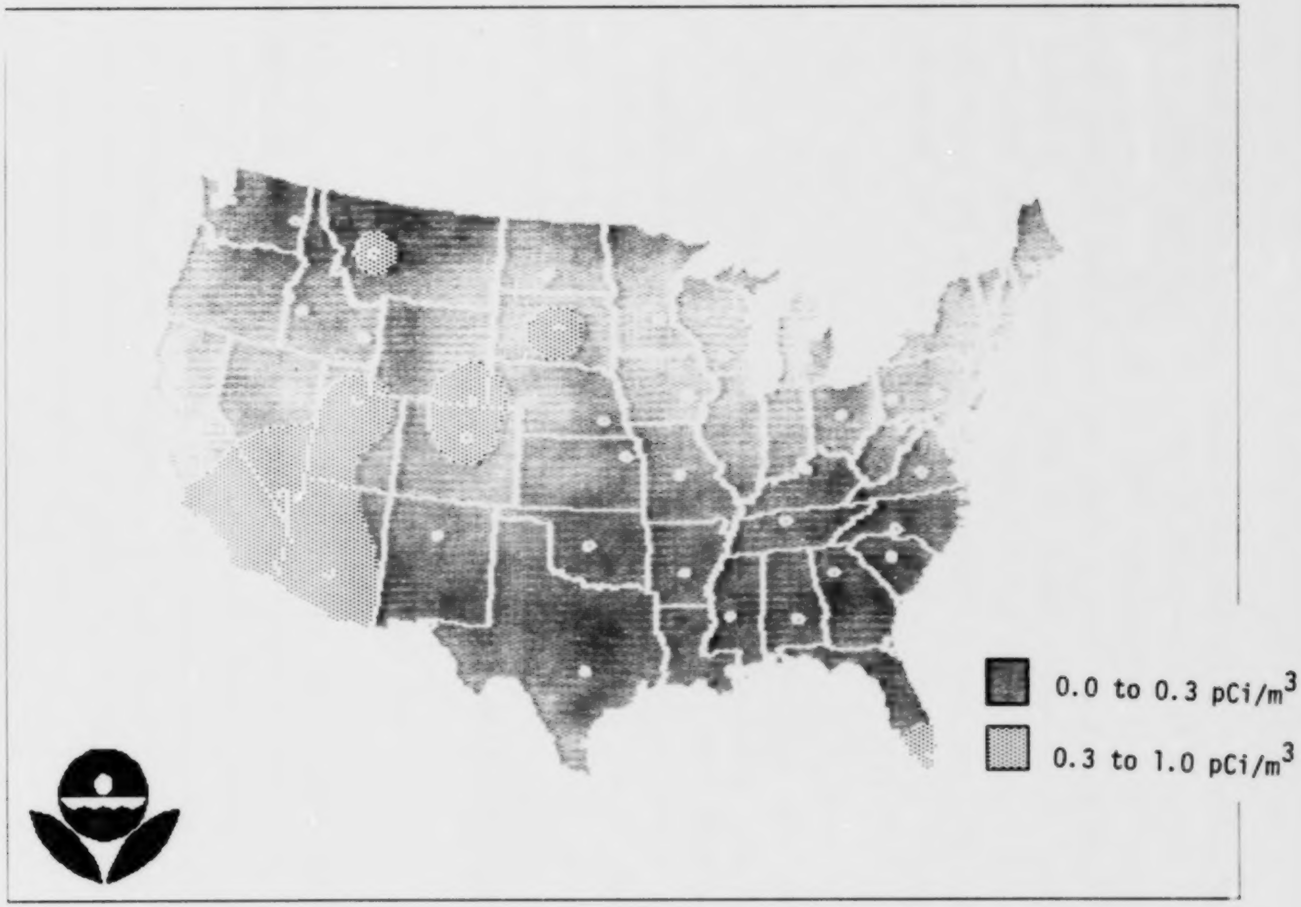
0.0 to 0.3 pCi/m3
0.3 to 1.0 pCi/m3

Fig. 11. Distribution of gross beta in airborne particulates (pCi/m^3). Laboratory measurements for October 14, 1977.

ambient background variations. These concentrations are rarely exceeded without the intrusion of a contaminating source such as the Chinese atmospheric nuclear test.

In reviewing Figs. 5 - 11, the chronological path of elevated gross-beta radioactivity levels can be followed across the U.S. Elevated levels of gross beta radioactivity in air particulates were first noted on September 25 in Hawaii and the western U.S. This activity was attributed to lower altitude trailing debris. U.S. levels peaked in the September 25 - 29 period but remained elevated in some areas until October 3rd and 4th when this trailing debris together with the second cloud passage had cleared the United States. The highest levels of activity were reported in Las Vegas, NV; Cheyenne, WY; Denver, CO; and Salt Lake City, UT.

A detailed summary of the airborne particulate data is given in Tables 6 and 7 of Report 12, Environmental Radiation Data (EPA78). Table 6 of this reference includes gamma results for samples with laboratory gross beta measurements greater than 1 pCi/m^3.

With the exception of a precipitation sample collected September 21, 1977, in Anchorage, AK, no measurable activity was detected in rainfall until September 26 when the trailing debris was spread across the United States. Gamma results of these precipitation samples are given in Table 8 of Report 12, Environmental Radiation Data (EPA78).

6.0 PASTEURIZED MILK MEASUREMENTS

Results for pasteurized milk samples collected September 23, 1977 - December 31, 1977, are presented in Table 13 of Report 12, Environmental Radiation Data (EPA78). From this data the geographical distributions of ^{131}I in milk for each week between September 25 and November 6, for the rest of November, and for December 1977 were prepared. Six of these distribution plots which show the trend in the level of ^{131}I in milk over this period are included as Figs. 12-17. By sequentially studying these geographical distributions, the buildup and subsequent decrease of ^{131}I levels in milk between September 25 and the first part of November can be observed. Only six sampling sites had detectable levels (above 10 pCi/ℓ) of ^{131}I during the first week of sample collection. However, during the second and third weeks, respectively, 49 and 47 of the 65 stations had ^{131}I levels exceeding 10 pCi/ℓ.

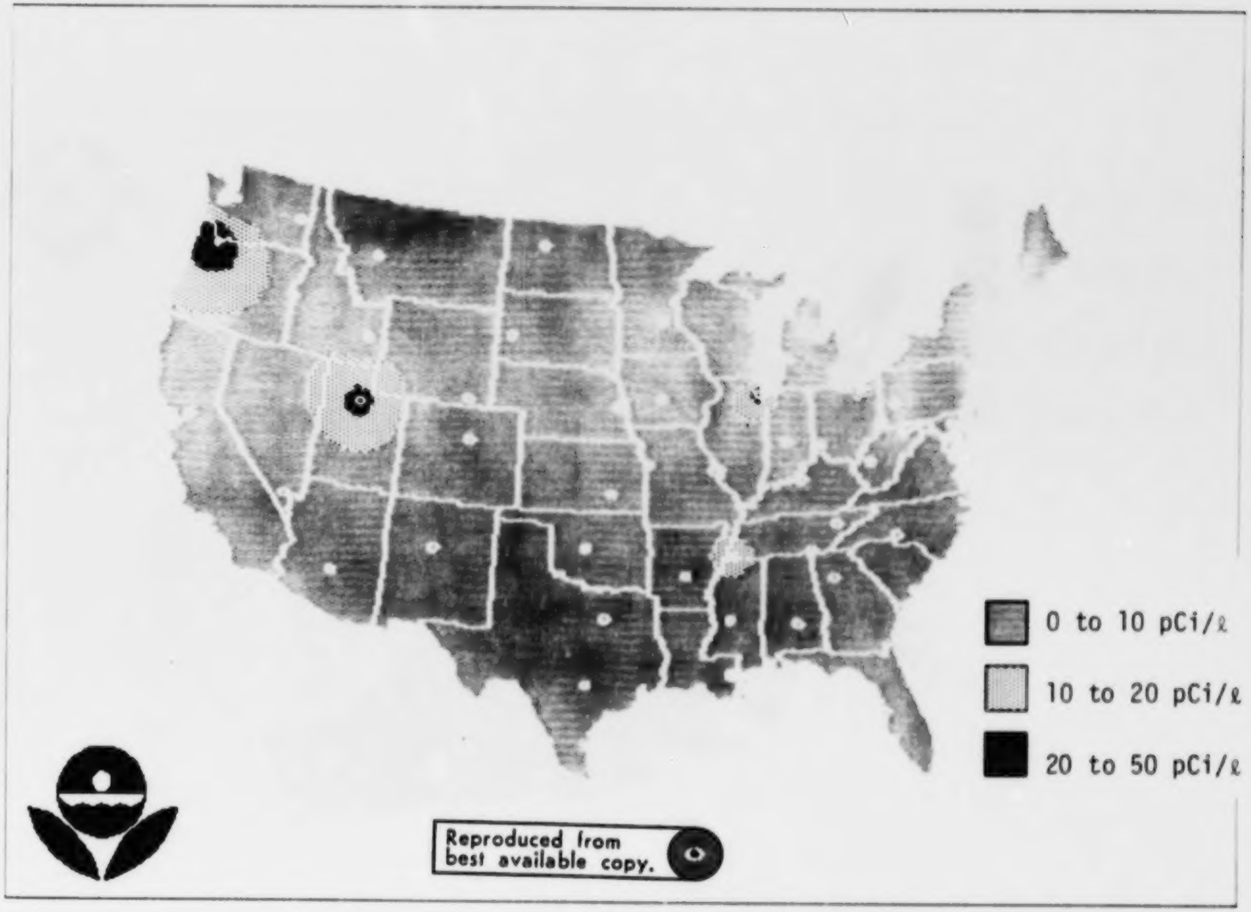
0 to 10 pCi/ℓ
10 to 20 pCi/ℓ
20 to 50 pCi/ℓ

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Fig. 12. Average concentration distribution of iodine-131 in milk (pCi/ℓ) for September 25 - October 1, 1977.

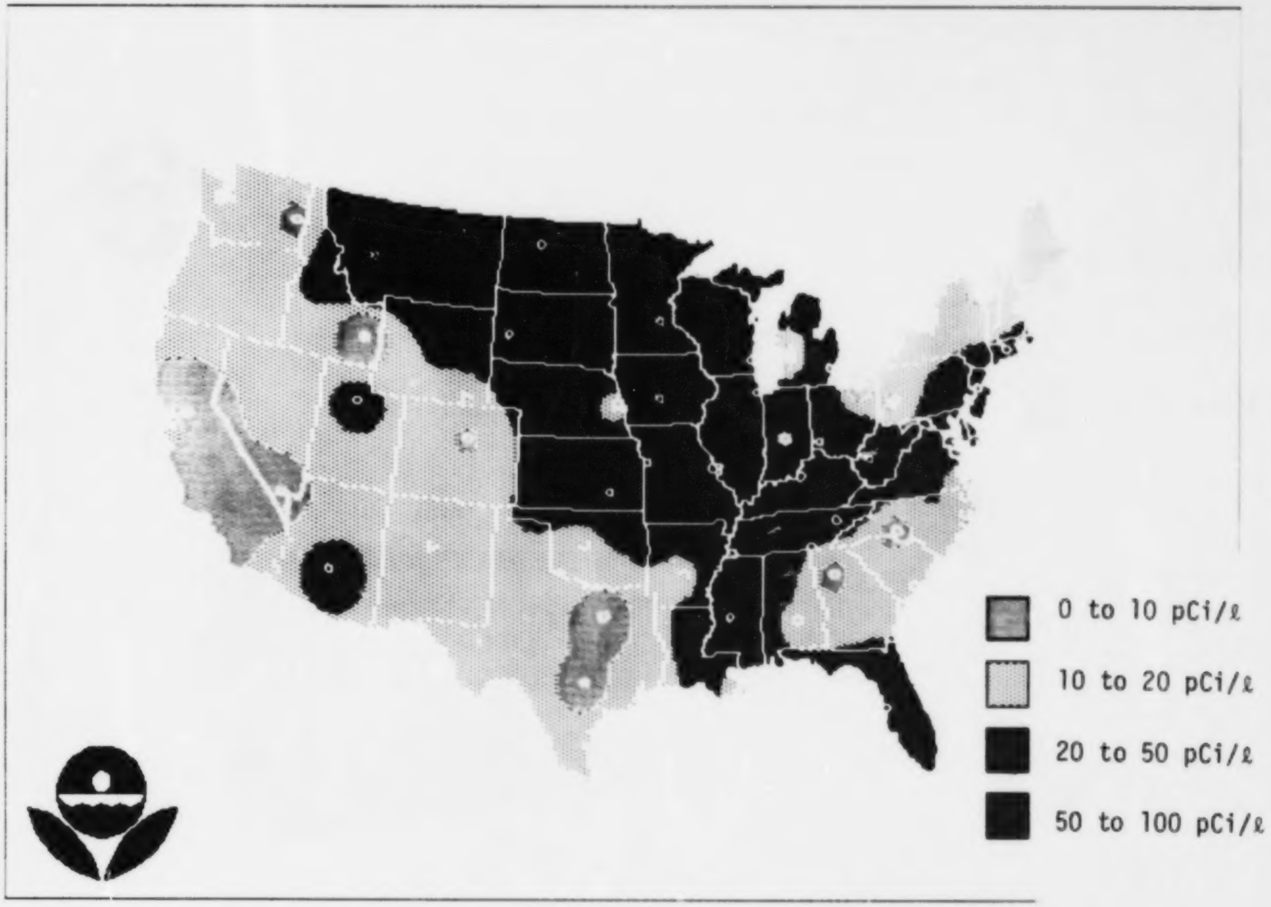
0 to 10 pCi/ℓ
10 to 20 pCi/ℓ
20 to 50 pCi/ℓ
50 to 100 pCi/ℓ

Fig. 13. Average concentration distribution of iodine-131 in milk (pCi/ℓ) for October 2 - 8, 1977.

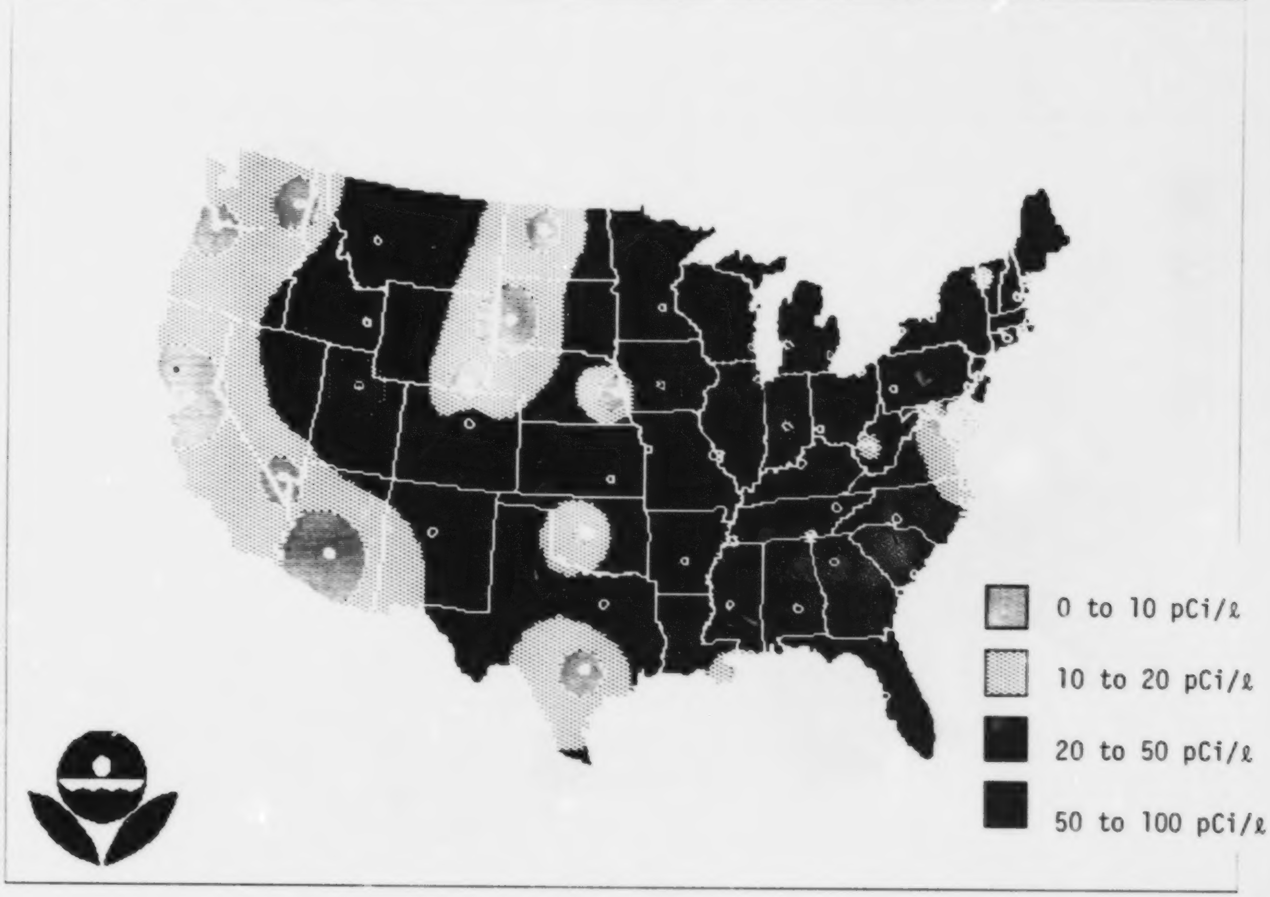
0 to 10 pCi/ℓ
10 to 20 pCi/ℓ
20 to 50 pCi/ℓ
50 to 100 pCi/ℓ

Fig. 14. Average concentration distribution of iodine-131 in milk (pCi/ℓ) for October 9 - 15, 1977.

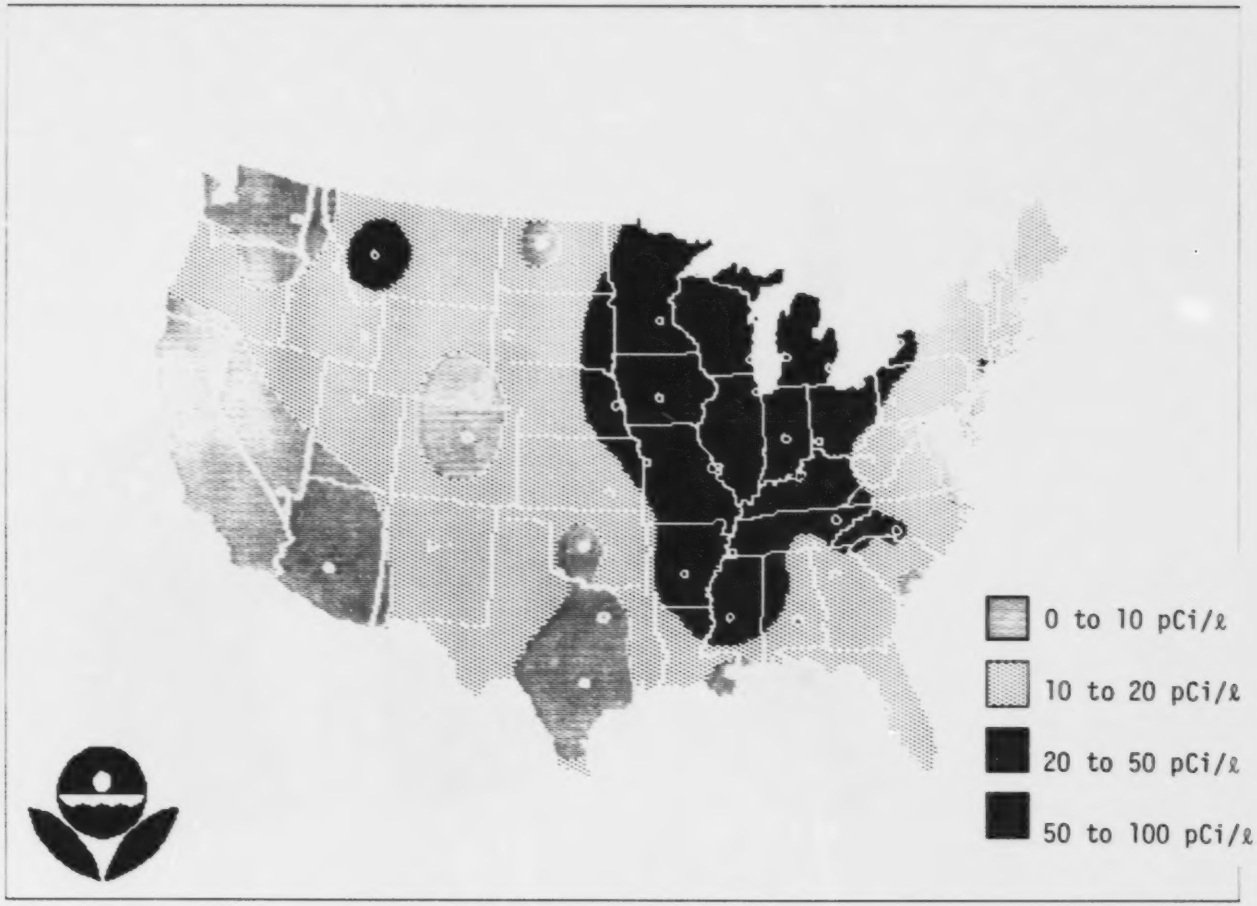
0 to 10 pCi/ℓ
10 to 20 pCi/ℓ
20 to 50 pCi/ℓ
50 to 100 pCi/ℓ

Fig. 15. Average concentration distribution of iodine-131 in milk (pCi/ℓ) for October 16 - 22, 1977.

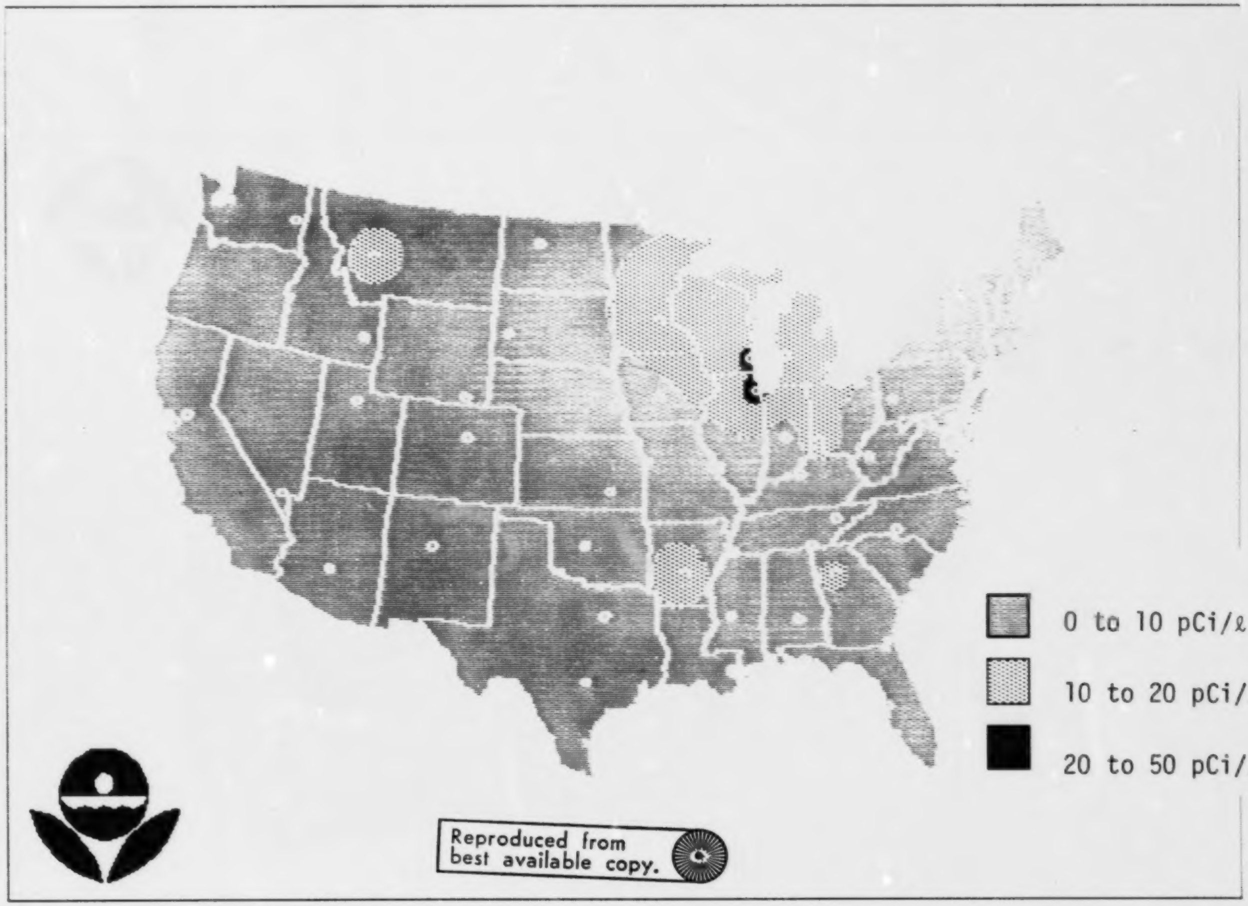
▨ 0 to 10 pCi/ℓ
▨ 10 to 20 pCi/ℓ
■ 20 to 50 pCi/ℓ

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Fig. 16. Average concentration distribution of iodine-131 in milk (pCi/ℓ) for October 23 - 29, 1977.

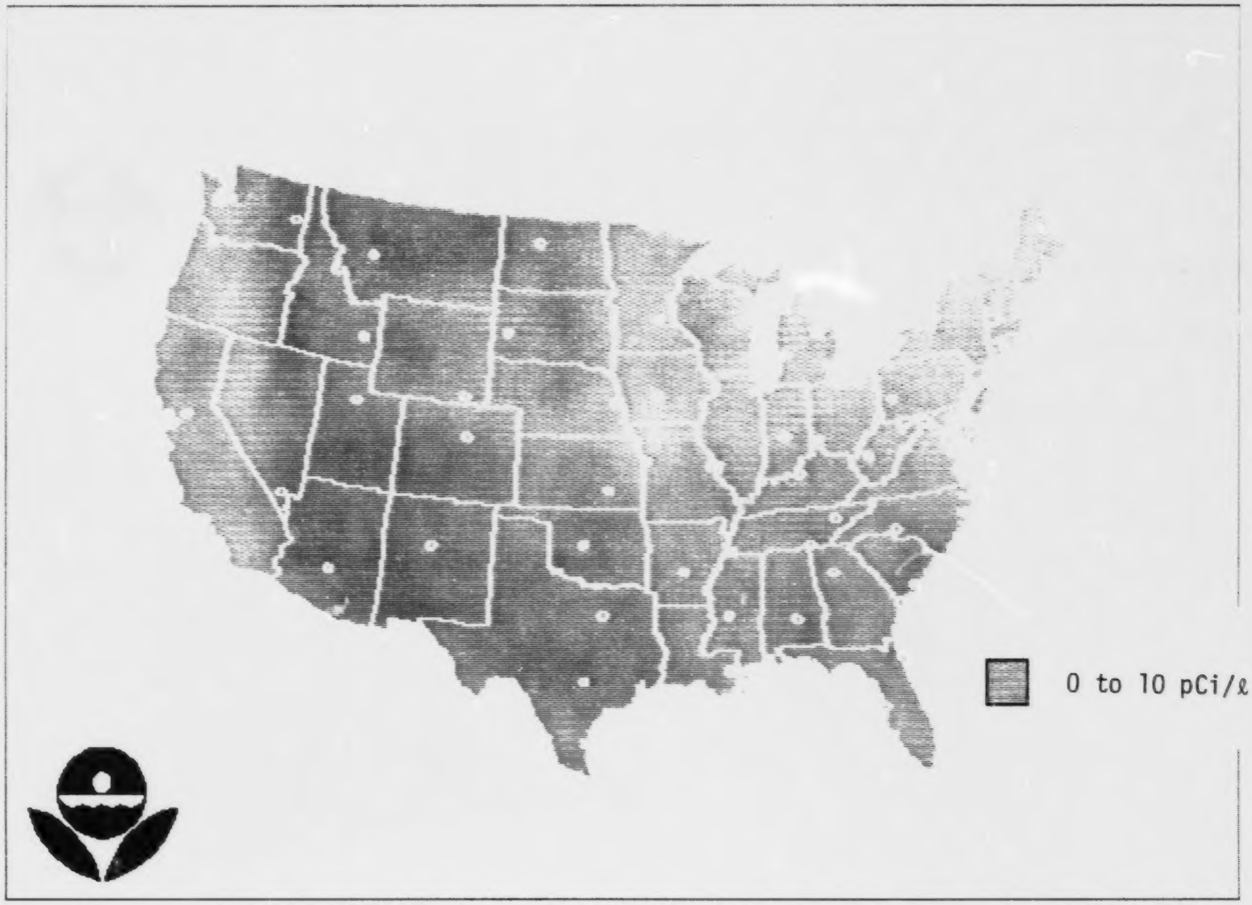

Fig. 17. Average concentration distribution of iodine-131 in milk (pCi/ℓ) for November 6 - 30, 1977.

Elevated levels were detected over the entire United States in contrast to the distribution following the September 26, 1976, detonation when elevated levels were concentrated in a few areas (EPA77a).

The highest ^{131}I value obtained for an ERAMS pasteurized milk sample was 119 pCi/ℓ at Anchorage, AK, collected September 30, 1977. This level was far below levels where EPA would recommend consideration of protective action.

In the samples analyzed for radiostrontium, little if any increase was detected in ^{90}Sr levels when compared to July 1977 data (EPA77b). However, many of the ^{89}Sr values showed significant increases, with a high value of 55 pCi/ℓ recorded for Little Rock, AR, on October 3. In July 1977 almost all of the ^{89}Sr levels were below the detection limit of 5 pCi/ℓ. These concentrations of ^{89}Sr in milk were not considered to be a health hazard.

7.0 RADIATION DOSE ASSESSMENTS*

7.1 Dose Types and Pathways

Radiation doses** to humans from fallout radionuclides occur as a result of external and internal radiation. Skin and total body external radiation doses occur due to submersion of people in the air containing fallout radionuclides and due to irradiation of the body from radionuclides deposited on the ground and on vegetation. The only external doses considered in this report are submersion doses since measured concentrations of radionuclides on the ground surfaces were not available in the ERAMS data. Internal doses result from inhalating of air or ingesting food or water containing fallout radionuclides. Vegetation contaminated by direct fallout or uptake of deposited radionuclides from the soil may be consumed either directly by humans or by animals (such as dairy cows) which provide human food. Thus the fallout radionuclides find their way into the human body by ingestion of foods, either directly by the vegetation pathway or indirectly by a vegetable to animal pathway. Historically, consumption of ^{131}I in cows milk (^{131}I-milk-thyroid dose pathway) has been the most significant contributor to doses to humans from fallout radionuclides.

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*EPA has assessed the short-term impact on public health in the United States which may be attributed to radioactive fallout from the Chinese atmospheric nuclear test of September 17, 1977. Over the long term, most of the fallout will be deposited on the earth, contributing to a slight increase in background levels. This long-term impact is not assessed in this report. The analysis is also restricted to those environmental pathways for which direct measurements of radioactivity are available in the medium which transmits radioactivity or radiation exposure directly to man (for example, milk that is drunk by man). Furthermore, only the radionuclides that are measured in the ERAMS samples are considered in this anlaysis.

**In this report, the term "dose" is used broadly to mean "absorbed dose" (rads) or "dose equivalent" (rems) and applies only to radiation protection. The term "dose" refers to either internal or external pathways. For internal pathways, dose refers to the dose committed during the integration period; and for external pathways, dose refers to the dose delivered during the integration period. Individual doses are reported in mrem and population doses are reported in man-rems. For ^{131}I, the dose commitment factors for ingestion are expressed in mrad per pCi ingested. We assumed that 1 mrad of dose is equal to 1 mrem of dose equivalent for ^{131}I.

In this document, doses are reported for eight organs*. The pathways contributing to these doses are--

(a) ingestion of radionuclides in pasteurized milk** - the radionuclides are deposited on grass which is consumed by dairy cows. Transfer of the radionuclides to milk takes place within the cows.

(b) inhalation of air particulates*** - the radionuclides are inhaled and deposited in the lung where they remain or where they can be dissolved for transfer by the blood to various body organs. Some inhaled material is transported up the respiratory tree and then swallowed. The body treats this fraction of inhaled material as it does ingested material.

(c) submersion in the radionuclides present in air*** - the radionuclides directly irradiate the receptor.

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*Doses are calculated to the organs bone, liver, thyroid, kidney, lung, and GI-LLI. Doses are also calculated to skin and total body. In discussing the calculated doses, we include skin and total body in the "organ" category and, for simplicity, refer to the doses to eight organs.

**Includes ^{89}Sr, ^{90}Sr, ^{131}I, ^{137}Cs, ^{140}Ba, ^{140}La. ^{140}La is assumed to be in equilibrium with ^{140}Ba.

***Includes ^{95}Zr,Nb, ^{103,106}Ru, ^{131}I, ^{137}Cs, ^{140}Ba, ^{140}La, ^{141,144}Ce.

Doses for the meat and leafy vegetable pathways were not calculated for the following reasons:

(a) Direct measurements of radionuclide levels in meat and leafty vegetables were not available. Also, the growing season for many fresh leafy vegetables has ended by late September, October, and November.

(b) The calculational accuracy of doses for these pathways would be substantially less than for the milk pathway, since samples of meat and leafy vegetables are not collected and analyzed routinely. To calculate these doses, one would have to use measured air concentrations to predict meat and leafy vegetable concentrations. Several uncertainties would be encountered in calculating doses for these pathways which are not encountered in the calculations summarized in this report. These uncertainties include predicting--

- deposition onto grass and leafy vegetables;
- fraction of cattle feed represented by fresh grass;
- fraction of vegetable consumption represented by fresh vegetables; and
- transfer coefficients to human food.

Radionuclide levels in drinking water samples were not elevated above background following this event. For this reason, the drinking water pathway is not included in these calculations. Although, data are available at some stations on radioactivity in precipitation samples, this pathway was not included since precipitation does not represent a direct dose pathway to man.

7.2 EERF Gamma Scanning Procedures

EERF uses primarily sodium iodide gamma scanning for specific nuclide analysis of fallout samples. For these procedures, the following nuclides occur under common peaks:

- ^{103}Ru and ^{106}Ru and ^{7}Be
- ^{95}Zr and ^{95}Nb
- ^{141}Ce and ^{144}Ce

Due to the occurrence of these nuclides under common peaks, it is not possible to quantify the amount of a specific nuclide in a sample. For example, the amount of ^{95}Zr + ^{95}Nb in a sample can be determined, but the amount of ^{95}Zr alone or ^{95}Nb alone can not be determined. Thus, for each of these three nuclide groups, the total quantity of all isotopes contributing to the peak are reported and the dose commitment factor for the nuclide with the highest specific dose commitment factor (highest mrem/pCi) is applied for the nuclide group. This approach is conservative since the assumption is made that all of the radioactive material contributing to a peak leads to the highest dose possible for that peak.

7.3 Dose Estimates for Individuals

Maximum* individual doses for eight organs were calculated for four age groups for each state.

Equations. The equation used for the individual dose calculations is:

$$ID_{sao} = \sum_{n=1}^{9} \left\{ \left[\sum_{p=1}^{2} (C_{psn})(IR_{pa})(DCF_{pnao}) \right] + 24(C_{3sn})(DCF_{3nao}) \right\} \qquad \text{(Eq. 1)}$$

where:

a = summation index for age group (4 age groups)
n = summation index for nuclide (9 nuclides)
o = index for organ
p = summation index for pathway (1 for milk, 2 for air inhalation, 3 for air submersion)
s = summation index for state (51 states; including all states and DC)

---

*Since the pasteurized milk samples are composited from several milk supplies in a state, it is possible that higher doses could have been calculated for an individual who drinks milk from a single dairy or who drinks unprocessed milk from a single farm. Also, it is possible that air concentrations of radionuclides could be higher at a location other than the sampling location(s) within a state.

ID_{sao} = individual dose for integration period to organ o, for age group a, in state s (mrem)*

C_{psn} = integrated radionuclide concentration for pathway p, state s, and nuclide n corrected to sample collection date (pci-d/ℓ for milk or pCi-d/m^3 for air)**

IR_{pa} = intake rate for pathway p and age group a (/d for milk; m^3/day for air)

DCF_{pnao} = dose commitment factor*** for pathway p, nuclide n, age group a, and organ o (for milk and air inhalation mrem/pCi intake; for air sumbersion mrem/hr per pCi/m^3)

24 = hours in one day

Age groups. For all of the calculations (individual and population dose calculations) the receptors were divided into four age groups to account for the variation of dose with age. The age groups described in NRC Regulatory Guide 1.109 (NRC77) were used as follows:

Infant	0 - 1 year
Child	1 - 12 years
Teenager	12 - 18 years
Adult	18 years and over

Milk pathway. The milk consumption rates for the individual dose calculations are shown in Table 1 and are based on information in ICRP #23 (ICRP75). The milk consumption rates for each age group are the maximum listed in Table 125 of ICRP #23 for that age group. The reported consumption rates varied from 0.13 ℓ/d for a female over 60 to 1ℓ/d for a male 6 months old. After examining the data on radionuclide levels in pasteurized milk, it was obvious that radionuclide concentrations in milk started increasing in late September and were approaching background again by November 10. Thus an integration period of September 17 - December 1, 1977, (75 days) was chosen for the milk samples.

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*1,000 mrem equals 1 rem. The rem is the product of the absorbed dose (rads), an assigned quality factor, and other necessary modifying factors specific for the radiation considered.

**The curie (Ci) is a measure of radionuclide transformation rate. One Ci equals 3.7×10^{10} transformations per second. There are 10^{12} picocuries (pCi) per Ci.

***Dose commitment is the dose that will be delivered during the 50-year period following radionuclide intake.

Inhalation pathway. The air inhalation rates for the individual dose calculations are shown in Table 1 and are based on information in ICRP #23. The

TABLE 1

Milk ingestion and air inhalation rates for reference individuals in each age group (ICRP75)

Age group	Milk ingestion rate, ℓ/d	Air inhalation rate, m^3/d
Infant	1.0	2.3
Child	0.58	10.4
Teen	0.47	19.5
Adult	0.33	22.0

air inhalation rates for each age group are based on averaging* data given in ICRP #23 for that age group. There are large variations in breathing rates depending on age and amount of physical activity. There can be factors of 5 and 13 variation between breathing rate at rest and during maximal exercise for an adult and a child, respectively. The numbers used are based on 16 hours per day of light activity and 8 hours per day of rest except for the infant. The infant breathing rate is based on 10 hours per day of light activity and 14 hours per day of rest.

A review of the radionuclide levels in air showed that the highest particulate concentrations generally occurred in a period between September 17 and October 14. However, the precise integration periods for airborne radionuclides varied from station to station since the integrations were stopped 5 days after the radionuclide concentration in air had returned to near background levels.

Dose commitment factors. The dose commitment factors used for the internal dose calculations express the internal dose that will be delivered for a unit quantity of radionuclide ingested or inhaled. The dose commitment factors for inhalation and milk ingestion are from NRC Regulatory Guide 1.109 (NRC77), except for ^{131}I in milk. These are from Kereiakes (Ke76) and are based on more recent ^{131}I thyroid uptake fractions than the factors in Regulatory Guide 1.109. The dose factors used for external dose calculations express the external dose rate per unit concentration of radionuclide in air. The dose factors for submersion are from the FESALAP report (AEC73) since they are not given in Regulatory Guide 1.109. The dose commitment factors and dose factors used in these analyses are listed in Appendix A. In general, the ratios of the maximum to minimum values of dose commitment factors or dose factors as as reported in the literature are less than 2. However, the International Commission on Radiological Protection (ICRP) is developing new methods for computing dose commitment factors. When this new methodology becomes available, variations in dose commitment factors larger than the stated factor of 2 may occur.

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*For the milk pathway, the maximum intake used in the calculations always occurs for the youngest age within the age group except for the infant for whom maximum milk consumption occurs at 6 months. The maximum breathing rate occurs for the oldest age within each age group. Since the largest contribution to individual doses from all pathways should result from ^{131}I in milk, we decided to use the maximum milk consumption and the average air consumption to represent the critical receptor in each age group. This approach should be slightly conservative.

Integrated radionuclide concentrations in milk and air. The integrated milk and air concentrations* used in equation 1 were obtained by fitting a cubic-spline (Re67) to the radionuclide levels measured in ERAMS samples and numerically integrating the resulting curve expressing radionuclide levels vs. time (see Appendix A for additional information). Representative curves for ^{131}I concentrations in milk at Anchorage, AK, and ^{141,144}Ce concentrations in air at Denver, CO, are shown in Figs. 18 and 19. The integrated concentrations of the radionuclides detected in milk and air are tabulated for all ERAMS locations in Appendix A. After the tabulations for the locations in each state, a state average tabulation is included which is obtained by an arithmetic average of the data for the locations in each state. For a more detailed discussion of the representativeness of these integrated milk and air concentrations see Section 7.4.

Discussion of calculated doses. The state average integrated concentrations are used with equation 1 to compute the individual doses discussed in this report. In Appendix A, we have tabulated, by state, the results of the individual dose calculations for each age group. The maximum calculated individual doses for each organ are listed in Table 2 along with the state and age group for these maximum doses. From a review of the information in this table, it can be seen that the highest individual dose (20.5 mrem) is for the thyroid of an infant in Anchorage, AK. The majority of this dose is contributed from ^{131}I ingested in milk. The maximum bone dose and lung doses are each approximately 25 percent of the maximum thyroid dose and the maximum liver dose and kidney dose are each approximately 5 percent of the maximum thyroid dose. Thus, the thyroid dose is dominant, but doses to the bone and the lung are within an order of magnitude of the thyroid dose.

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*Net concentrations for milk; gross concentrations for air, since radionuclide-specific background air concentrations are not available.

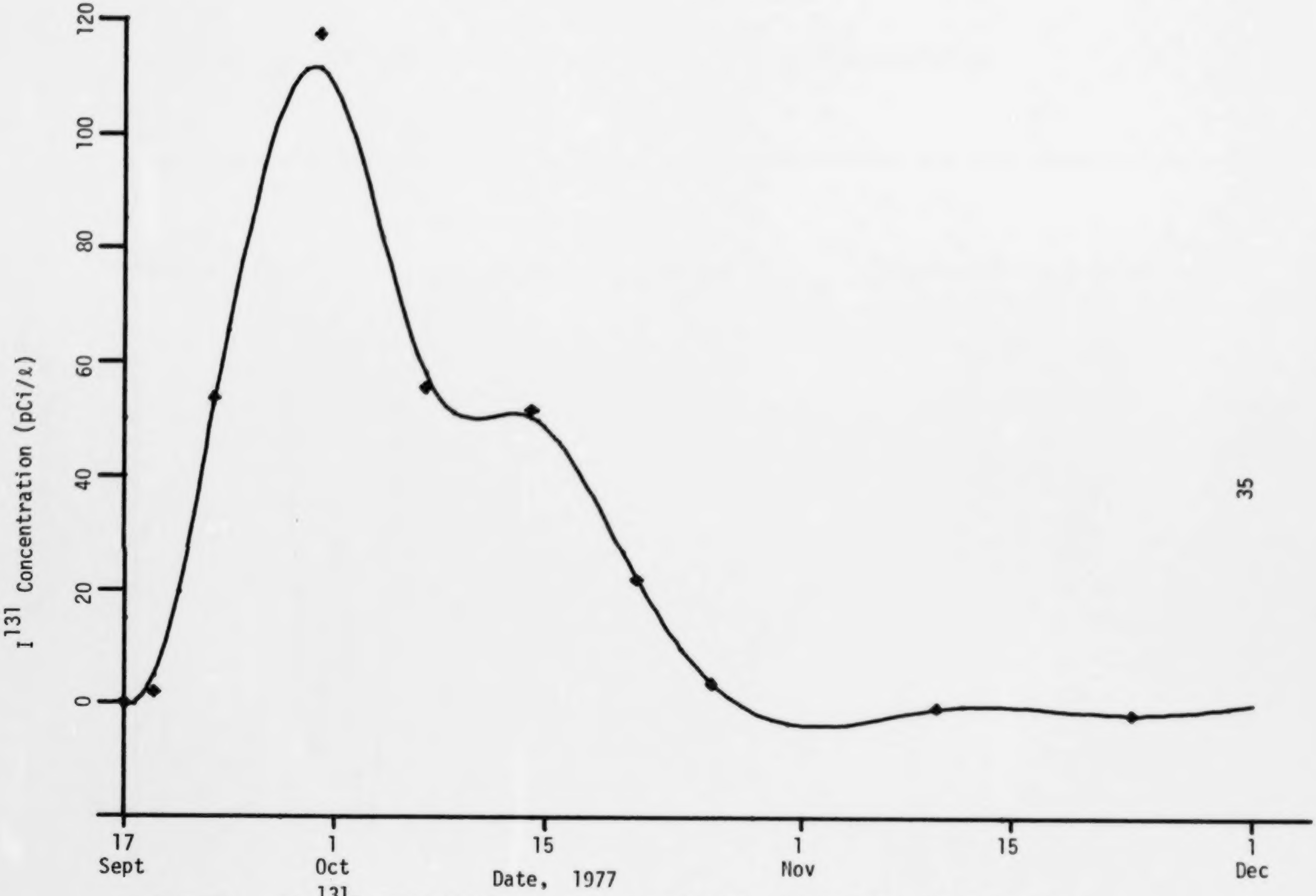

Fig. 18. Net ^{131}I concentration in milk as a function of date for Anchorage, AK.

TABLE 2

Maximum individual doses as a function of organ, age, and state

Organ	Age group	State	Individual* dose, mrem
Bone	Infant	Minnesota	4.7
Liver	Infant	Minnesota	1.2
T. body	Infant	Minnesota	1.0
Thyroid	Infant	Alaska	20.5
Kidney	Infant	Minnesota	1.1
Lung	Child	Colorado	5.7
Gi-lli	Adult	Colorado	0.4
Skin	Infant	Minnesota	1.0

*Gross doses (no background subtracted) are included for the air inhalation and submersion pathways since background levels for specific isotopes in air are not available. The milk pathway contributions are net values (background subtracted) since background levels for specific isotopes in milk are available. The submersion dose contribution is the same for all age groups.

7.4 Population Dose Calculations

Population dose is computed by summing the individual doses for all members of a population. It has units of persons times dose (man-rem).

Equation for population dose. The equation used to calculate state population doses for each organ is:

$$PD_{so} = \sum_{n=1}^{9} \sum_{a=1}^{4} \left\{ \begin{array}{l} \dfrac{(1000)(C_{1sn})(MC_s)(f_{1a})(DCF_{1nao})}{(D)(\rho)} \displaystyle\sum_{d=1}^{2} (f_d)\exp(-\lambda_n t_d) \\ +(.001)(C_{2sn})(P_s)(f_{2a}) \left[(IR_{2a})(DCF_{2nao}) + (24)(DCF_{3nao}) \right] \end{array} \right\} \qquad \text{(Eq. 2)}$$

where:

PD_{so} = state population dose to organ during the period September 17 - December 1, 1977 (man-rem)

1000 = conversion factor (lbs. - rem/Mlbs.-mrem)

.001 = conversion factor (rem/mrem)

d = summation index for food group (2 food groups)

MC_s = total fluid milk and fluid milk products consumed in state during integration period (man-Mlbs. consumed or committed for consumption)

f_d = fraction of milk used for food group d (dimensionless)

f_{pa} = for milk, fraction of total milk consumption used by age group a; for air, fraction of total state population in age group a (dimensionless)

DCF_{pnao} = dose commitment factor for pathway p, nuclide n, age group a, and organ o (for milk, mrem/pCi ingested; for air inhalation, mrem/pCi inhaled; for air submersion, mrem/hr per pCi/m^3)

λn = radioactive decay constant for nuclide n (d^{-1})

t_d = time between sample collection and consumption (d)

D = days in period of integration for milk pathway

ρ = milk density (lbs/ℓ)

P_s = population in state s (people)

C_{psn}, IR_{pa}, 24, and the indexes a, n, o, p, and s have the same definition as for the individual dose calculations. The first line of equation 2 is for population dose from milk ingestion and the second line is for population dose from air inhalation and submersion.

State milk and air concentrations. The pasteurized milk portion of the

ERAMS network includes 63 sampling locations within the United States. Radionuclide levels in milk were reported for at least one sampling location in each state following the test. The air portion of ERAMS includes 22 regular sampling stations and 43 standby sampling locations (a total of 65 sampling locations) within the United States. For five states, radionuclide concentrations in air were not reported following the test. In the other states, at least one sampling station per state reported air concentrations. In general radionuclide concentrations in milk and air* were available for one or more samples per week for each milk and air location reporting.

The integrated milk and air concentrations of each nuclide at each location were obtained using a cubic spline and numerical integration techniques as discussed earlier and in Appendix A. For states with only one sampling location, the integrated milk and air concentrations for that location were used for the entire state. For the states where there were no air sampling locations, air concentrations from a nearby location were used as an estimate of air concentrations in the state. For states with more than one sampling location, an arithmetic average of the data for the locations in the state was used. There is a limitation in the accuracy of these calculations since it was assumed that one, or in a few cases two, three, or four, sampling locations were representative of an entire state. Obviously, the accuracy could be improved by substantially expanding the sampling network to include several locations and wider geographical coverage in each state. However, while this may be the largest uncertainty in these calculations, a substantial expansion of the ERAMS sampling network would significantly increase the cost of the program. Also, improved accuracy does not seem warranted because estimates of fallout related health effects are low in this as well as previous assessments (EPA77a). The use of a single sampling location to represent milk consumed in each state is supported by the following:

(1) The milk samples are a weighted composite of milk from each major milk processor supplying an area. The samples are representative of locally consumed milk whether the processor obtained it from local or remote supplies.

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*Net concentrations for milk; gross concentrations for air, since radionuclide-specific background air concentrations are not available.

(2) Many processors supply the smaller cities and towns in a state as well as the metropolitan areas where these milk samples were taken.

The use of a single sampling location to represent air concentrations in each state is supported by consideration of the large plume size after traveling the great distance from the point of formation in China to the U.S. Thus, the fallout plume may cover several states when it enters the U.S. and large variations in radionuclide concentrations within a state would not normally be expected. As mentioned previously, the integrated concentrations of the radionuclides detected in milk and air are tabulated for each state in Appendix A (Table A2).

State milk products consumption. The total U.S. milk production of 24,016 million pounds for the integration period was obtained by using the U.S. Department of Agriculture (USDA) milk production rate data for September, October, and November 1977 (DOA77). We assumed that the entire domestic milk production would be consumed within the U.S. The milk consumption within individual states was estimated by taking the ratio of total state population to total U.S. population (BOC73) and multiplying by the estimated milk production for the U.S. (see Appendix A). These assumptions were discussed with USDA personnel, who agreed that they are reasonable (DOA78). The estimated milk consumption for each state is shown in Table 3.

Milk usage. The fraction of the total milk consumption going into different dairy products was estimated using USDA milk utilization data for 1975 (DOA76). After discussions with USDA dairy personnel (DOA78) regarding the time between marketing and consumption of various dairy products, we decided to establish two food groups (described further in Appendix A) as follows:

Food Group 1: Includes butter, ice cream, cheese, canned and condensed milk, dry milk, and other manufactured products. Fraction of total U.S. milk consumption (f_d) equals 0.52. Marketing-to-consumption time (t_d) equals 30 d.

Food Group 2: Includes fluid milk products, cottage cheese, and residual milk. Fraction of total U.S. milk consumption (f_d) equals 0.48. Marketing-to-consumption time (t_d) equals 1 d.

TABLE 3

Estimated population and milk consumption for each state

State	Population (no. of people)	Estimated milk consumption (million lbs.)
ALASKA	3.820E+05	4.274E+01
ALABAMA	3.665E+06	4.100E+02
ARKANSAS	2.109E+06	2.360E+02
ARIZONA	2.270E+06	2.540E+02
CALIFORNIA	2.152E+07	2.408E+03
COLORADO	2.583E+06	2.890E+02
CONNECTICUT	3.117E+06	3.487E+02
D.C.	7.020E+05	7.854E+01
DELAWARE	5.820E+05	6.511E+01
FLORIDA	8.421E+06	9.421E+02
GEORGIA	4.970E+06	5.560E+02
HAWAII	8.870E+05	9.924E+01
IOWA	2.870E+06	3.211E+02
IDAHO	8.310E+05	9.297E+01
ILLINOIS	1.123E+07	1.256E+03
INDIANA	5.302E+06	5.932E+02
KANSAS	2.310E+06	2.584E+02
KENTUCKY	3.428E+06	3.835E+02
LOUISIANA	3.841E+06	4.297E+02
MASSACHUSETTS	5.809E+06	6.499E+02
MARYLAND	4.144E+06	4.636E+02
MAINE	1.070E+06	1.197E+02
MICHIGAN	9.104E+06	1.019E+03
MINNESOTA	3.965E+06	4.436E+02
MISSOURI	4.778E+06	5.346E+02
MISSISSIPPI	2.354E+06	2.634E+02
MONTANA	7.530E+05	8.424E+01
NORTH CAROLINA	5.469E+06	6.119E+02
NORTH DAKOTA	6.430E+05	7.194E+01
NEBRASKA	1.553E+06	1.737E+02
NEW HAMPSHIRE	8.220E+05	9.196E+01
NEW JERSEY	7.336E+06	8.207E+02
NEW MEXICO	1.168E+06	1.307E+02
NEVADA	6.100E+05	6.825E+01
NEW YORK	1.808E+07	2.023E+03
OHIO	1.069E+07	1.196E+03
OKLAHOMA	2.766E+06	3.095E+02
OREGON	2.329E+06	2.606E+02
PENNSYLVANIA	1.186E+07	1.327E+03
RHODE ISLAND	9.270E+05	1.037E+02
SOUTH CAROLINA	2.848E+06	3.186E+02
SOUTH DAKOTA	6.860E+05	7.675E+01
TENNESSEE	4.214E+06	4.715E+02
TEXAS	1.249E+07	1.397E+03
UTAH	1.228E+06	1.374E+02
VIRGINIA	5.032E+06	5.630E+02
VERMONT	4.760E+05	5.325E+01
WASHINGTON	3.612E+06	4.041E+02
WISCONSIN	4.609E+06	5.156E+02
WEST VIRGINIA	1.821E+06	2.037E+02
WYOMING	3.900E+05	4.363E+01
US TOTAL	2.147E+08	2.402E+04

Age dependent milk consumption and population distribution fractions. The NRC Regulatory Guide 1.109 age groups discussed previously were used for the population dose calculations. U.S. age-dependent population data for 1968 and 1969 (BOC70) were used to estimate the fraction of the population in each age group (f_{2a}, Table 4). Using Equation 3, age-dependent per capita milk consumption data (R_a, Table 4) from ICRP #23 (ICRP75) were combined with the age-dependent population fractions (f_{2a}, Table 4) to obtain the fractional milk consumption, f_{1a}, for each age group in the U.S. population:

$$f_{1a} = \frac{(f_{2a})\,(R_a)}{\sum_{a=1}^{4}(f_{2a})\,(R_a)} \qquad \text{(Eq. 3)}$$

where:

f_{2a} = age distribution fraction for age group a (dimensionless)

R_a = reference man average milk consumption rate for age group a (ℓ /d).

Other data. The food group fractions (f_d) were applied to all states and all age groups, and the age group fractions (f_{pa}) were applied to all states and to both food groups. In reality, f_d is probably a function of state and age group and f_{pa} is probably a function of state and food group. Information was not readily available to define f_d and f_{pa} as functions of these quantities and, considering other uncertainties in the calculation, we believe that this interaction is not significant.

The population for each state is estimated as of July 1, 1976, and was taken from the 1978 edition of the Information Please Almanac (IPA77). The populations used for each state are listed in Table 3. A milk density of 2.3 lbs/ℓ (CRC69) was used. The radiological half-lives and dose commitment fac-

TABLE 4

Age distribution, absolute milk consumption, and milk consumption distribution for the U.S. population

Age group	Age distribution fractions f_{2a}	Reference man milk consumption (ICRP75) (ℓ/d) R_a	Milk consumption distribution fractions f_{1a}
Infant (0-1 y)	0.02	0.72	0.04
Child (1-12 y)	0.21	0.46	0.33
Teenage (12-18 y)	0.12	0.38	0.15
Adult (over 18 y)	0.65	0.22	0.48

tors discussed previously and tabulated in Appendix A were applied. The intake rates for air discussed previously and given in Table 1 were used for the population dose calculations.

Calculated dose. Using the methods, equation, and data discussed, the population doses shown in Table 5 were calculated for each state. The lung, thyroid, and bone doses were the highest of the organ doses calculated. In general, the highest population doses west of the Mississippi River and in the Southeast were for the lung. In the eastern section of the Midwest, in the northern portion of the Southeast, and in the Northeast, the highest population doses were generally for the thyroid. In eight states, the population dose was highest for the bone. The maximum population doses in each state along with a code letter to indicate the organ are shown in Fig. 20. The population dose geographical distributions for the thyroid and the lung are shown in Figs. 21 and 22, respectively.

The highest lung population dose is 18,400 man-rem in California, while the highest thyroid population dose is 14,000 man-rem in Illinois. The highest bone population dose is 16,300 man-rem in Illinois. For the total U.S. population, the highest doses are 150,200 man-rem to the lung, 127,700 man-rem to the thyroid, and 107,600 man-rem to the bone. Doses to the other organs considered in these calculations were from one-fourth to one-tenth of these highest doses.

8.0 HEALTH EFFECTS ASSESSMENT

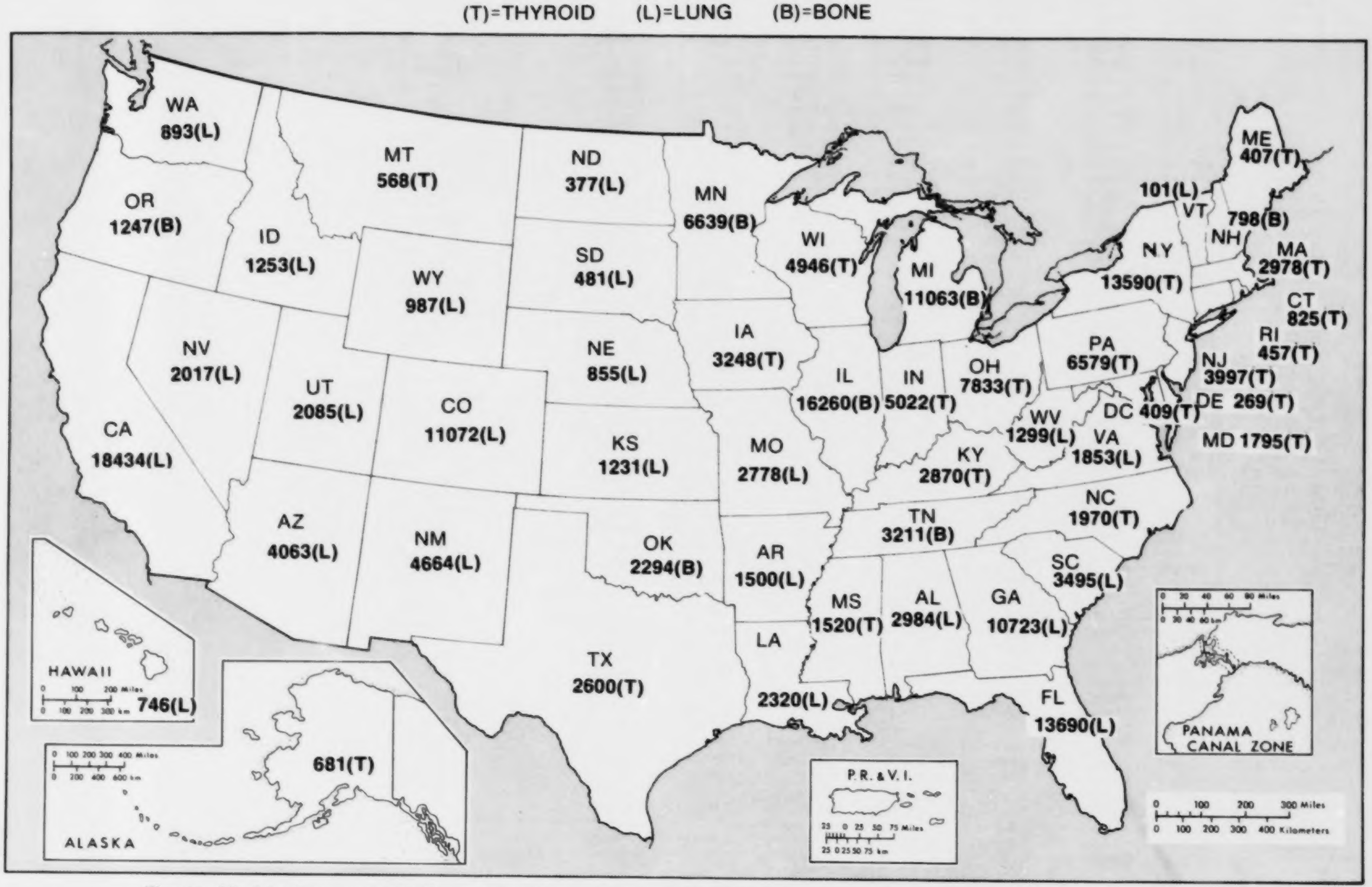
8.1 Relationship Between Radiation Doses and Health Effects

In considering the effects of releasing pollutants to the environment, the information of primary importance is the effect that the pollutants may have on human health. In the field of radiation protection, the trend has been for regulatory agencies to set permissible limits on radiation dose rather than directly limiting health impacts. In setting these dose limits,

TABLE 5

Population doses (man-rem) as a function of state and organ.

State	Organ Bone	Liver	T. Body	Thyroid	Kidney	Lung	Gi-Lli	Skin
ALASKA	4.89E+02	1.25E+02	1.08E+02	6.81E+02	1.16E+02	1.83E+02	2.43E+01	1.08E+02
ALABAMA	1.24E+03	2.20E+02	5.59E+01	1.63E+03	1.68E+02	2.98E+03	3.45E+02	5.87E+01
ARKANSAS	1.29E+03	1.95E+02	6.23E+01	1.48E+03	1.29E+02	1.50E+03	2.35E+02	6.38E+01
ARIZONA	8.40E+02	3.00E+02	4.94E+01	9.03E+02	2.09E+02	4.06E+03	3.46E+02	5.33E+01
CALIFORNIA	6.12E+03	2.23E+03	8.54E+02	3.31E+03	1.54E+03	1.84E+04	1.78E+03	8.71E+02
COLORADO	3.49E+03	1.26E+03	4.31E+02	2.60E+03	8.92E+02	1.11E+04	8.67E+02	4.41E+02
CONNECTICUT	5.20E+02	7.86E+01	3.11E+01	8.25E+02	4.79E+01	5.15E+02	1.23E+02	3.16E+01
D.C.	3.07E+02	9.41E+01	6.65E+01	4.09E+02	7.92E+01	3.22E+02	3.40E+01	6.67E+01
DELAWARE	9.69E+01	4.98E+01	1.47E+01	2.69E+02	2.18E+01	1.66E+02	3.02E+01	1.48E+01
FLORIDA	6.22E+03	1.91E+03	9.78E+02	4.41E+03	1.55E+03	1.37E+04	1.15E+03	9.91E+02
GEORGIA	2.80E+03	8.73E+02	2.63E+02	2.03E+03	6.57E+02	1.07E+04	9.20E+02	2.73E+02
HAWAII	8.21E+01	1.80E+01	6.84E+00	2.56E+02	1.87E+01	7.46E+02	6.41E+01	7.50E+00
IOWA	1.15E+03	1.93E+02	6.81E+01	3.25E+03	1.26E+02	1.12E+03	1.70E+02	6.91E+01
IDAHO	3.12E+02	1.26E+02	2.49E+01	5.83E+02	7.84E+01	1.25E+03	1.09E+02	2.61E+01
ILLINOIS	1.63E+04	3.87E+03	3.47E+03	1.40E+04	3.62E+03	5.88E+03	9.13E+02	3.47E+03
INDIANA	3.92E+03	9.28E+02	6.55E+02	5.02E+03	8.24E+02	4.35E+03	4.81E+02	6.59E+02
KANSAS	6.58E+02	1.91E+02	4.96E+01	1.00E+03	1.08E+02	1.23E+03	1.45E+02	5.08E+01
KENTUCKY	2.25E+03	5.66E+02	3.89E+02	2.87E+03	4.48E+02	1.48E+03	2.33E+02	3.90E+02
LOUISIANA	3.87E+02	1.44E+02	2.58E+01	1.29E+03	1.09E+02	2.32E+03	1.97E+02	2.80E+01
MASSACHUSETTS	1.21E+03	3.35E+02	9.47E+01	2.98E+03	1.91E+02	1.98E+03	2.43E+02	9.66E+01
MARYLAND	7.10E+02	2.20E+02	5.48E+01	1.80E+03	1.30E+02	1.56E+03	1.46E+02	5.63E+01
MAINE	1.67E+02	2.70E+01	8.16E+00	4.07E+02	1.98E+01	2.25E+02	6.99E+01	8.39E+00
MICHIGAN	1.11E+04	2.55E+03	2.07E+03	9.56E+03	2.34E+03	8.07E+03	9.37E+02	2.08E+03
MINNESOTA	6.64E+03	1.70E+03	1.52E+03	6.55E+03	1.59E+03	2.35E+03	2.96E+02	1.53E+03
MISSOURI	2.53E+03	5.59E+02	4.31E+02	2.68E+03	5.19E+02	2.78E+03	3.29E+02	4.33E+02
MISSISSIPPI	1.10E+03	1.00E+02	4.16E+01	1.52E+03	8.44E+01	1.07E+03	2.03E+02	4.26E+01
MONTANA	1.59E+02	5.75E+01	1.46E+01	5.68E+02	3.44E+01	4.55E+02	4.93E+01	1.51E+01
NORTH CAROLINA	2.63E+02	9.11E+01	2.32E+01	1.97E+03	6.93E+01	1.20E+03	1.37E+02	2.43E+01
NORTH DAKOTA	2.68E+02	8.93E+01	5.57E+01	1.99E+02	6.94E+01	3.77E+02	3.63E+01	5.60E+01
NEBRASKA	3.27E+02	9.08E+01	2.12E+01	3.95E+02	5.69E+01	8.55E+02	1.04E+02	2.20E+01
NEW HAMPSHIRE	7.98E+02	2.19E+02	1.91E+02	5.48E+02	2.01E+02	3.55E+02	3.92E+01	1.91E+02
NEW JERSEY	1.22E+03	3.16E+02	9.69E+01	4.00E+03	1.87E+02	1.97E+03	2.73E+02	9.87E+01
NEW MEXICO	8.97E+02	3.09E+02	9.00E+01	3.61E+02	2.41E+02	4.66E+03	3.55E+02	9.43E+01
NEVADA	3.80E+02	1.43E+02	2.30E+01	2.88E+02	9.92E+01	2.02E+03	1.53E+02	2.49E+01
NEW YORK	9.35E+03	2.32E+03	1.60E+03	1.36E+04	1.86E+03	6.75E+03	9.54E+02	1.60E+03
OHIO	4.96E+03	1.32E+03	7.42E+02	7.83E+03	1.02E+03	6.62E+03	7.09E+02	7.48E+02
OKLAHOMA	2.29E+03	6.45E+02	5.41E+02	8.06E+02	5.83E+02	1.61E+03	1.30E+02	5.42E+02
OREGON	1.25E+03	2.78E+02	2.44E+02	1.02E+03	2.68E+02	8.80E+02	1.36E+02	2.45E+02
PENNSYLVANIA	2.05E+03	7.25E+02	2.17E+02	6.58E+03	3.69E+02	3.49E+03	3.84E+02	2.20E+02
RHODE ISLAND	2.74E+02	4.05E+01	1.41E+01	4.57E+02	2.69E+01	2.84E+02	5.30E+01	1.44E+01
SOUTH CAROLINA	8.46E+02	2.90E+02	4.94E+01	1.39E+03	2.00E+02	3.50E+03	3.11E+02	5.28E+01
SOUTH DAKOTA	2.19E+02	5.53E+01	1.18E+01	3.73E+02	3.66E+01	4.81E+02	6.03E+01	1.23E+01
TENNESSEE	3.21E+03	7.68E+02	4.96E+02	2.97E+03	6.14E+02	2.63E+03	3.45E+02	4.99E+02
TEXAS	7.64E+02	2.36E+02	8.93E+01	2.60E+03	1.86E+02	2.46E+03	2.89E+02	9.16E+01
UTAH	5.05E+02	1.82E+02	3.76E+01	1.34E+03	1.21E+02	2.08E+03	1.93E+02	3.96E+01
VIRGINIA	1.20E+03	3.41E+02	2.34E+02	1.00E+03	3.03E+02	1.85E+03	1.75E+02	2.36E+02
VERMONT	9.13E+01	2.16E+01	6.29E+00	6.84E+01	1.15E+01	1.01E+02	2.40E+01	6.39E+00
WASHINGTON	8.52E+02	2.79E+02	1.85E+02	8.81E+02	2.20E+02	8.93E+02	9.98E+01	1.85E+02
WISCONSIN	2.94E+03	5.47E+02	3.84E+02	4.95E+03	4.80E+02	2.28E+03	3.42E+02	3.85E+02
WEST VIRGINIA	4.27E+02	1.42E+02	3.22E+01	1.12E+03	8.96E+01	1.30E+03	1.13E+02	3.34E+01
WYOMING	1.98E+02	7.10E+01	1.14E+01	1.28E+02	4.92E+01	9.87E+02	7.50E+01	1.24E+01
TOTAL U. S.	1.08E+05	2.84E+04	1.72E+04	1.28E+05	2.30E+04	1.50E+05	1.59E+04	1.74E+04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UT 2085(L)
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MA 2978(T)
CT 825(T)
RI 457(T)
NJ 3997(T)
DE 269(T)
MD 1795(T)
DC 409(T)
HAWAII 746(L)
ALASKA 681(T)
P.R. & V.I.
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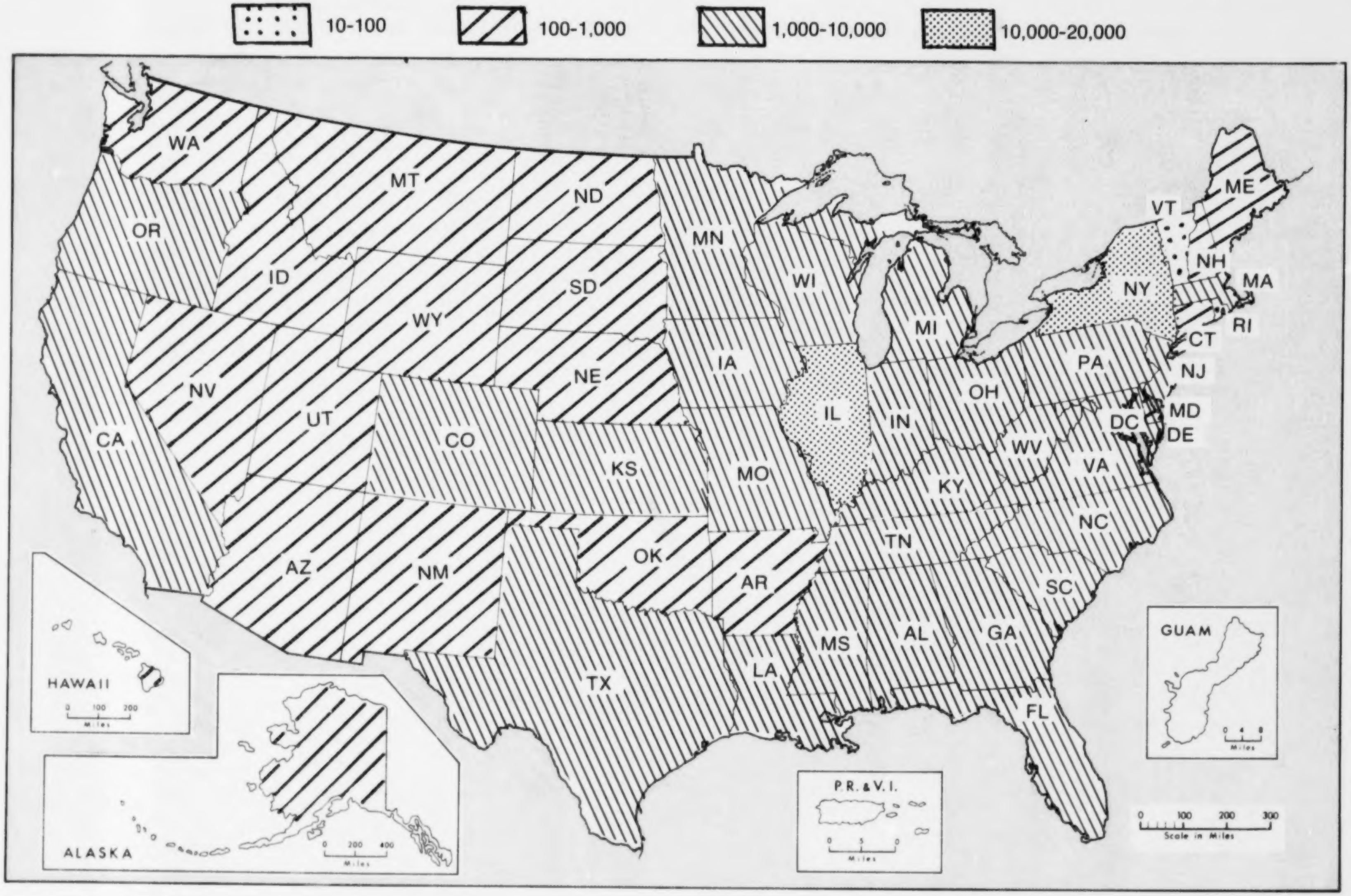
0 100 200 300 400 Kilometers

Figure 20. Maximum population doses (man-rem) by State for the September 17, 1977 Chinese nuclear weapons test.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MS
MI
IN
TN
AL
OH
KY
GA
WV
PA
VA
NC
SC
FL
NY
VT
ME
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NJ
MD
DE
DC
HAWAII
ALASKA
P.R. & V.I.
GUAM
Miles
Scale in Miles
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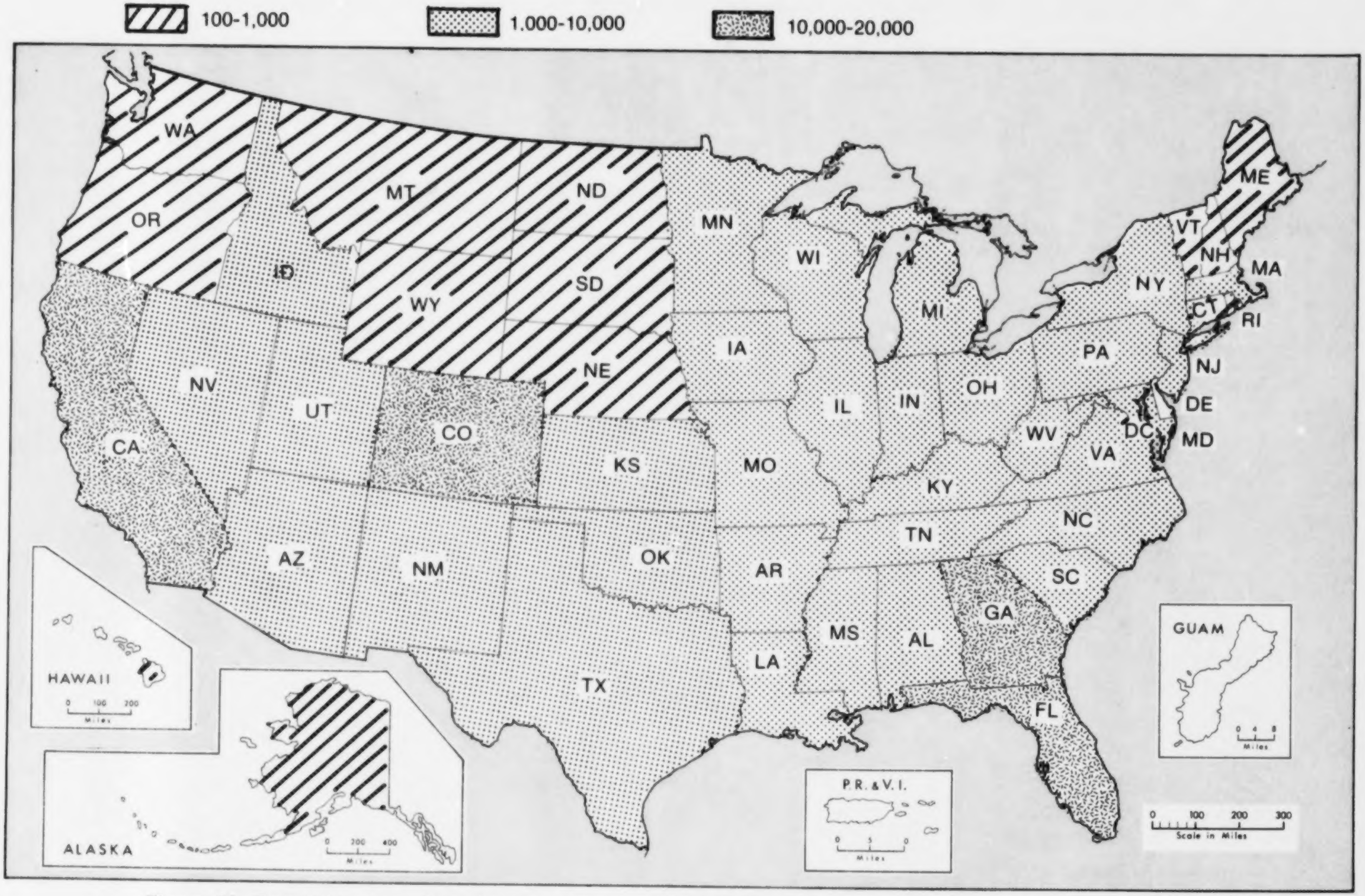
200
300
400
4
5
8

Figure 21. Population thyroid dose (man-rem) geographical distribution for the September 17, 1977 Chinese nuclear weapons test.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IN
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NY
PA
VT
NH
ME
MA
CT
RI
NJ
DE
MD
DC
WV
VA
KY
TN
NC
SC
GA
AL
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AR
MO
KS
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TX
NM
CO
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AZ
NV
CA
HAWAII
0 100 200
Miles
ALASKA
0 200 400
Miles
P.R. & V.I.
0 5 0
Miles
GUAM
0 4 8
Miles
0 100 200 300
Scale in Miles

Figure 22: Population lung dose (man-rem) geographical distribution for the September 17, 1977 Chinese nuclear weapons test.

the health impact of radiation doses at the levels specified in the limits are considered. However, the probabilities for occurrence of various maladies due to radiation releases are not directly discernible without going a step beyond the dose calculations.

More recently, the radiation protection community has begun to take this additional step--to relate radiation doses directly to the potential health impact. In this report, EPA has chosen to present both dose estimates and estimates of the impact on public health as a result of this atmospheric nuclear weapons test. To estimate the health impacts, dose-to-risk conversion factors were selected. These factors and the estimated public health impact are presented in Section 8.2. A more detailed discussion of EPA policy on the relationship between radiation dose and health effects is given in Appendix B.

8.2 Projected Health Effects

Health effects have been estimated for the thyroid, lung, and the remainder of the total body (exclusive of lung and thyroid). The EPA estimates of increases in occurrence of cancers and deaths due to this fallout event are listed in Table 6 along with the dose-to-risk conversion factors used to calculate the risks (EPA73, EPA77c). It is estimated that about 17 cancers and about 10 deaths might occur over the next 45 years as a result of this test. A comparison of these projected deaths with the deaths due to natural occurrence of cancers from all causes lends perspective to these calculations. In 1975, 365,700 persons in the U.S. died from all types of cancers (MVSR77). Assuming a constant death rate, one projects the natural occurrence of 16,456,200 deaths from all types of cancer over a 45-year period. Thus the excess death rate is about one extra death for every 1,600,000 deaths occurring from all types of cancer. We estimate that there might be 3 serious genetic effects to all succeeding generations of the U.S. population as a result of this nuclear test. Considering the current incidence rate of serious genetic effects of 6% (NAS72), we estimate that there might be about 12,900,000 serious genetic effects from all causes in the U.S. during the next 50 years.

TABLE 6

Health effects estimates for the U.S. population for the Chinese nuclear test of September 17, 1977

Organ	Somatic health effects per million man-rem (EPA73, EPA77c)		Population dose estimate (man-rem)	Estimated somatic health effects during the next 45 years due to this test*	
	Cancer	Death		Cancer	Death
Thyroid (I-131)	11[†]	1.1	1.11×10^5	1.2	.12
Thyroid (other than I-131)	106	10.6	1.70×10^4	1.8	.18
Lung	50	50	1.50×10^5	7.5[§]	7.5[§]
Total body [††]	350	139	1.72×10^4	6.0[§]	2.4[§]
			Total estimated somatic health effects for this event	16.5	10.2

[*] In addition to the somatic health effects listed in this table, if the assumption is made that the gonadal dose is equal to the total body dose, it is estimated that 3 serious genetic effects might occur to the U.S. population across all succeeding generations as a result of this test.

[†] This thyroid cancer estimate is approximately six times lower than the number used in EPA's previous analysis of health effects from nuclear weapons tests (EPA77a). The change is the result of two factors: an increase in the plateau length, as a function of time, for expressing excess thyroid cancers for the 0-2 years old age group; and a factor of ten decrease in the cancer risk per person rad for I-131 since beta particles from I-131 were considered less carcinogenic than photon radiation (EPA77c).

[††] Exclusive of lung and thyroid health effects.

[§] The time required for complete expression of these effects is the lifetime of the exposed population. However, the majority of these effects should be within the next 45 years.

9.0 DISCUSSION

9.1 Philosophy Regarding Calculation of Environmental Doses and Effects

A traditional practice among health physicists has been to estimate high when calculating doses and health effects in order to develop conservative criteria for protecting the public health and safety. However, in recent years, there has been a tendency within the profession to be conservative only when calculating radiation protection, design, and criteria-setting values. The goal now when calculating doses and health effects from an actual event is to produce realistic estimates. Accordingly, the parameters in this report were selected so as to yield realistic dose estimates.

Another practice, common among engineers, that has been followed in this study has been to avoid spending time refining the value of one parameter to a few percent uncertainty when there is another parameter in the calculations that cannot be so refined. For example, the most uncertain numbers in our dose calculations probably are the integrated milk and air concentrations, because they are based on only one (in a few cases two to four) sampling location per state. We have not refined the values of other parameters in the study because we believe they are more certain than the integrated milk and air concentrations.

9.2 Review of Calculational Uncertainties for Dose Calculations

For many of the parameters used in these dose calculations, a range of values were reported in the literature. Realistic values for parameters from within the range of reported numbers have been chosen instead of values that would lead to the highest dose estimate.

Discussions of uncertainties in values chosen for these parameters appear in Section 7. These parametric uncertainties are summarized in the following discussion.

Laboratory data. In this study, we used available data for the dose calculations. Even when milk and air concentrations fell below the minimum detectable levels (MDL's) (see Table 7), we used those concentrations as best estimates of actual concentrations. Although other methods are available for treating concentrations that fall below the MDL's, we believe that using available data produces the most realistic estimates of dose.

To calculate net radionuclide concentrations in milk, we estimated background concentrations from using ERAMS data for July, August, and September (prior to September 17) 1977. These months were chosen because they immediately preceded the weapons test, and, during this period, no nuclear events had taken place in the world that would have tended to increase background levels of radionuclides in milk in the United States. However, a longer time period for establishing background would be preferable, and EPA intends to pursue a more precise method for determining background. Gross radionuclide concentrations for air were used for the calculations since background radionuclide levels for air were not available.

Sampling locations. It is assumed that one (and in a few cases two, three, or four) milk* and air sampling locations are representative of an entire state. The milk samples are composites of consumed milk from several processors, which makes them more representative of the states than if the samples were from only one processor. The air concentrations would not be expected to vary markedly within a state due to the large size of the plume after traveling to the U.S. from China. However, it is believed that the small number of milk and air samples in each state may be the most limiting factor regarding the accuracy of these dose calculations. Without samples from additional locations in each state, it is not possible to quantify the magnitude of this uncertainty.

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*Milk samples were composited for major metropolitan areas.

TABLE 7
Minimum detectable levels (MDL) at the 2-σ confidence level for nuclides detected in milk and air

Nuclide	MDL in milk (pCi/ℓ)	MDL in air* (pCi/m^3)
^{89}Sr	5	
^{90}Sr	1	
^{95}Zr-^{95}Nb		.010
$^{103,106}Ru$		.030
^{131}I	10	.007
^{137}Cs	10	.007
^{140}Ba	10	.007
^{140}La		.007
$^{141,144}Ce$		.030

*1400 m^3 sample.

Milk ingestion and air inhalation data. For the individual dose calculations, the maximum milk ingestion rate listed in ICRP #23 was used for each age group. These maximum ingestion rates were about 1.5 times higher than the average milk ingestion rates. For the population dose calculations for milk, actual USDA milk production data for September, October, and November 1977 were used to estimate total consumption during the integration period. Use of the milk for fluid consumption and for manufactured products was estimated using USDA data for calendar year 1975. The milk consumption values should be relatively free of uncertainty. A slight conservatism was introduced into the calculation by establishing only two milk usage groups with consumption times of 1 day for group 1 and 30 days for group 2. Actual consumption times (DOA78) for some specific products in group 2 were as long as six months. However, we estimate that this conservatism increases the milk population dose to be high by less than a factor of 1.5.

To calculate the individual and population doses from air, we used the average inhalation rate for each age group. There are large variations in breathing rates depending on age and amount of physical activity. There can be factors of 5 and 13 variation between breathing rate at rest and during maximal exercise for an adult and a child respectively. However, the breathing rates used are based on about 16 hours per day of light activity and about 8 hours per day of rest and are believed to be realistic for the bulk of the U.S. population.

Dose commitment factors. The dose commitment factors that we used are age dependent and taken from Regulatory Guide 1.109 (NRC77), Kereiakes et al. (Ke76), and the FESALAP report (AEC73). We believe these dose commitment factors to be realistic and within a factor of 2 variation from other dose commitment factors reported in the literature. However, the International Commission on Radiological Protection is developing new recommendations for computing dose commitment factors. When this new methodology becomes available, variations in dose commitment factors larger than the stated factor of 2 may occur.

In general, uncertainty in dose calculations is minimized when realistic parameters are used. However, available value of parameters are likely to be much more realistic for groups than for individuals. For example, one five-year old may drink substantially more milk than another. If data were available on only a few five-year olds, the likelihood of uncertainty in dose calculations would be considerably increased. But, if data were available on the milk consumption of a large group of five-year olds, a realistic mean milk consumption of five-year olds could be derived and applied to the dose calculations. Thus, uncertainty usually decreases for population dose calculations and increases for individual dose calculations.

9.3 Significance of Estimated Doses and Health Effects

A prudent position for radiation protection is that any amount of radiation exposure is potentially harmful and that any unnecessary exposure to ionizing radiation should be discouraged. With this in mind, it would certainly be preferable to abolish atmospheric nuclear testing in all countries and thereby avoid this source of unnecessary population dose to the world's population. However, we believe that the population doses and health effects to the U.S. population from this nuclear test will be small compared to other sources of doses and health effects. The health effects to the U.S. population from this test will be undetectable because of the larger influence of other sources of the same health effects.

10.0 SUMMARY AND CONCLUSIONS

10.1 Summary

EPA has assessed the short-term* impact on public health in the United States that may be attributed to radioactive fallout from the Chinese atmospheric nuclear test of September 17, 1977. The initial pass of the cloud was calculated to reach the western coast of the U.S. on September 21. EPA activated the standby air particulate and precipitation stations of ERAMS on September 17 and 18. The frequency of sample collection for the nationwide pasteurized milk network was increased to a weekly interval and the first milk samples were collected during the week of September 26, which was early in the buildup cycle of levels in milk.

Detectable levels of fresh fission products were documented in air, precipitation, and milk samples from the ERAMS program following this test. Although radioactivity levels in air particulates were quite low, fresh fission products were detected geographically throughout most of the U.S. and were significantly higher than those following the test of September 26, 1976 (EPA77a). Elevated levels of ^{131}I, ^{140}Ba, and ^{89}Sr in milk were also detected throughout most of the U.S., but did not approach levels where EPA would recommend considerating protective action. EPA continued the special sampling until it was obvious that there was not going to be a significant buildup of radionuclides in the environmental samples as a result of this event. Press releases were issued frequently during the sampling period after this event to keep the public informed.

The highest doses calculated and presented in the report are for lung, thyroid, and bone. The maximum calculated individual doses were 20.5 mrem to the thyroid (infant, Alaska), 5.7 mrem to the lung (child, Colorado), and 4.7 mrem to the bone (infant, Minnesota). The highest State lung population dose is 18,400 man-rem in California, while the highest State thyroid population dose is 14,000 man-rem in Illinois. The highest state bone population dose is 16,300 man-rem in Illinois. For the total U.S. population, the highest doses are 150,200 man-rem to the lung, 127,700 man-rem to the thyroid, and 107,600 man-rem to the bone. Doses to the other organs are one-fourth to one-tenth the magnitude of these highest doses. The total body population dose for the U.S. is 17,200 man-rems. We estimate that about 17 cancers and 10 deaths might occur as somatic effects during the next 45 years as a result of these population doses. Across all succeeding generations of the U.S. population, we estimate that about 3 serious genetic effects might occur due to this test. These numbers of potential health and genetic effects for the U.S. population are small and will be undetectable when compared to the estimated 16,500,000 deaths that might occur from other causes of cancer and the estimated 12,900,000 serious genetic effects that might occur in the U.S. over the next 45-50 years. Our assessment of potential health and genetic effects resulting from short-term fallout from this event indicates that it will not significantly affect the United States population.

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*Over the longterm, most of the fallout will be deposited on the earth, contributing to a slight increase in background levels. This long-term impact is not assessed in this report.

10.2 Conclusions

The major conclusion that can be drawn from evaluation of potential radiological health effects of the fallout from the September 1977 nuclear weapons test by the People's Republic of China is that this test will not contribute significant somatic and genetic effects in the United States. Any somatic and genetic effects due to this test will be masked by the occurrence of these effects from other causes.

APPENDIX A

Additional Information on Individual and Population Dose Calculations

This appendix provides details related to the dose calculations presented in this report.

A1. Dose conversion factors

The age-dependent dose commitment factors for inhalation and milk ingestion are from Regulatory Guide 1.109 (NRC77), except for ^{131}I in milk. These are from Kereiakes et al. (Ke76) and are based on more recent ^{131}I thyroid uptake fractions than the factors in Regulatory Guide 1.109. In cases where the dose commitment factor was not given for an organ for a particular nuclide, the total body dose commitment factor was used for that organ.

The dose factors for submersion are from the FESALAP report (AEC73) since they are not given in Regulatory Guide 1.109. In the FESALAP report, dose factors are listed only for total body and skin. The total body dose factors were used for the six organs that were not addressed in the FESALAP report. All of the dose conversion factors used in this report are tabulated in Table A1.

A.2 Integrated radionuclide concentrations in milk and air

The procedure used to integrate the raw data consisted of smoothing the data by the use of a cubic spline function and then analytically integrating the spline function. Using the spline in this manner provided not only a good method of integration but also a set of smooth curves for plotting purposes.

The smoothing routine used was a modification of one designed by Reinsch (Re67). Reinsch found the spline that minimized the integral of the square of the second derivative over the interval of interest. The spline was subject to the constraint that the sum of the squares of the ratio of the expected values less the actual values to the errors were less than some user specified "slack parameter." For example, a slack parameter of 0.0 would require exact interpolation.

This method was modified to accommodate the fact that Reinsch's method breaks down when the distance between successive abscissa values is widely

TABLE A1

Dose conversion factors

Units are mrem/pCi for air inhalation and milk ingestion.
Units are mrem/h per pCi/m**3 for air submersion.

Pathway: Milk

			Organ							
Age	Nuclide	Halflife,d	Bone	Liver	T. Body	Thyroid	Kidney	Lung	Gi-Lli	Skin
INFANT	I-131	8.05E+00	3.59E-05	4.23E-05	1.86E-05	9.95E-03	4.94E-05	1.86E-05	1.51E-06	1.86E-05
	BA-140	1.28E+01	1.71E-04	1.71E-07	8.81E-06	8.81E-06	4.06E-08	1.05E-07	4.20E-05	8.81E-06
	CS-137	1.10E+04	5.22E-04	6.11E-04	4.33E-05	4.33E-05	1.64E-04	6.64E-05	1.91E-06	4.33E-05
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	1.85E-02	4.71E-03	4.71E-03	4.71E-03	4.71E-03	4.71E-03	2.31E-04	4.71E-03
	SR-89	5.20E+01	2.51E-03	7.20E-05	7.20E-05	7.20E-05	7.20E-05	7.20E-05	5.16E-05	7.20E-05
	LA-140	1.67E+00	1.12E-08	8.32E-09	2.14E-09	2.14E-09	2.14E-09	2.14E-09	9.77E-05	2.14E-09
	CE-141,144	2.84E+02	2.98E-06	1.22E-06	1.67E-07	1.67E-07	4.93E-07	1.67E-07	1.71E-04	1.67E-07
	RU103,106,BE7	3.67E+02	2.41E-05	3.01E-06	3.01E-06	3.01E-06	2.85E-05	3.01E-06	1.83E-04	3.01E-06
	ZR,NB-95	6.58E+01	2.06E-07	5.02E-08	3.56E-08	3.56E-08	5.41E-08	3.56E-08	2.50E-05	3.56E-08
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CHILD	I-131	8.05E+00	1.73E-05	1.73E-05	9.83E-06	3.61E-03	2.84E-05	9.83E-06	1.54E-06	9.83E-06
	BA-140	1.28E+01	8.31E-05	7.28E-08	4.85E-06	4.85E-06	2.37E-08	4.34E-08	4.21E-05	4.85E-06
	CS-137	1.10E+04	3.27E-04	3.13E-04	4.62E-05	4.62E-05	1.02E-04	3.67E-05	1.96E-06	4.62E-05
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	1.70E-02	4.31E-03	4.31E-03	4.31E-03	4.31E-03	4.31E-03	2.29E-04	4.31E-03
	SR-89	5.20E+01	1.32E-03	3.77E-05	3.77E-05	3.77E-05	3.77E-05	3.77E-05	5.11E-05	3.77E-05
	LA-140	1.67E+00	1.01E-08	3.52E-09	1.19E-09	1.19E-09	1.19E-09	1.19E-09	9.84E-05	1.19E-09
	CE-141,144	2.84E+02	2.08E-06	6.52E-07	1.11E-07	1.11E-07	3.61E-07	1.11E-07	1.70E-04	1.11E-07
	RU103,106,BE7	3.67E+02	1.17E-05	1.46E-06	1.46E-06	1.46E-06	1.58E-05	1.46E-06	1.82E-04	1.46E-06
	ZR,NB-95	6.58E+01	1.16E-07	2.55E-08	2.27E-08	2.27E-08	3.65E-08	2.27E-08	2.66E-05	2.27E-08
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
TEEN	I-131	8.05E+00	5.85E-06	8.19E-06	4.40E-06	1.59E-03	1.41E-05	4.40E-06	1.62E-06	4.40E-06
	BA-140	1.28E+01	2.83E-05	3.48E-08	1.82E-06	1.82E-06	1.18E-08	2.33E-08	4.38E-05	1.82E-06
	CS-137	1.10E+04	1.12E-04	1.49E-04	5.19E-05	5.19E-05	5.07E-05	1.97E-05	2.12E-06	5.19E-05
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	8.30E-03	2.05E-03	2.05E-03	2.05E-03	2.05E-03	2.05E-03	2.33E-04	2.05E-03
	SR-89	5.20E+01	4.40E-04	1.26E-05	1.26E-05	1.26E-05	1.26E-05	1.26E-05	5.24E-05	1.26E-05
	LA-140	1.67E+00	3.48E-09	1.72E-09	4.55E-10	4.55E-10	4.55E-10	4.55E-10	9.82E-05	4.55E-10
	CE-141,144	2.84E+02	6.96E-07	2.88E-07	3.74E-08	3.74E-08	1.72E-07	3.74E-08	1.75E-04	3.74E-08
	RU103,106,BE7	3.67E+02	3.92E-06	4.94E-07	4.94E-07	4.94E-07	7.56E-06	4.94E-07	1.88E-04	4.94E-07
	ZR,NB-95	6.58E+01	4.12E-08	1.24E-08	8.94E-09	8.94E-09	1.91E-08	8.94E-09	3.00E-05	8.94E-09
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ADULT	I-131	8.05E+00	4.16E-06	5.96E-06	3.41E-06	1.11E-03	1.02E-05	3.41E-06	1.57E-06	3.41E-06
	BA-140	1.28E+01	2.03E-05	2.55E-08	1.34E-06	1.34E-06	8.68E-09	1.46E-08	4.18E-05	1.34E-06
	CS-137	1.10E+04	7.98E-05	1.09E-04	7.15E-05	7.15E-05	3.71E-05	1.23E-05	2.10E-06	7.15E-05
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	7.61E-03	1.86E-03	1.86E-03	1.86E-03	1.86E-03	1.86E-03	2.19E-04	1.86E-03
	SR-89	5.20E+01	3.09E-04	8.85E-06	8.85E-06	8.85E-06	8.85E-06	8.85E-06	4.94E-05	8.85E-06
	LA-140	1.67E+00	2.50E-09	1.26E-09	3.34E-10	3.34E-10	3.34E-10	3.34E-10	9.25E-05	3.34E-10
	CE-141,144	2.84E+02	4.89E-07	2.04E-07	2.62E-08	2.62E-08	1.21E-07	2.62E-08	1.65E-04	2.62E-08
	RU103,106,BE7	3.67E+02	2.75E-06	3.48E-07	3.48E-07	3.48E-07	5.31E-06	3.48E-07	1.78E-04	3.48E-07
	ZR,NB-95	6.58E+01	3.04E-08	9.76E-09	6.61E-09	6.61E-09	1.54E-08	6.61E-09	2.10E-05	6.61E-09
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01

TABLE A1 (Continued)

Pathway: Air inhalation

			Organ							
Age	Nuclide	Halflife,d	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Skin
INFANT	I-131	8.05E+00	2.71E-05	3.05E-05	1.40E-05	1.06E-02	3.70E-05	1.40E-05	7.56E-07	1.40E-05
	BA-140	1.28E+01	4.00E-05	4.00E-08	2.07E-06	2.07E-06	9.59E-09	1.14E-03	2.74E-05	2.07E-06
	CS-137	1.10E+04	3.92E-04	4.37E-04	3.25E-05	3.25E-05	1.23E-04	5.09E-05	9.53E-07	3.25E-05
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	2.92E-02	1.85E-03	1.85E-03	1.85E-03	1.85E-03	8.03E-03	9.36E-05	1.85E-03
	SR-89	5.20E+01	2.84E-04	8.15E-06	8.15E-06	8.15E-06	8.15E-06	1.45E-03	4.57E-05	8.15E-06
	LA-140	1.67E+00	3.61E-07	1.43E-07	3.68E-08	3.68E-08	3.68E-08	1.21E-04	6.06E-05	3.68E-08
	CE-141,144	2.84E+02	2.28E-03	8.65E-04	1.26E-04	1.26E-04	3.84E-04	7.03E-03	1.06E-04	1.26E-04
	RU103,106,BE7	3.67E+02	6.20E-05	7.77E-06	7.77E-06	7.77E-06	7.61E-05	8.62E-03	1.17E-04	7.77E-06
	ZR,NB-95	6.58E+01	8.24E-05	1.99E-05	1.45E-05	1.45E-05	2.22E-05	1.25E-03	1.55E-05	1.45E-05
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CHILD	I-131	8.05E+00	1.30E-05	1.30E-05	7.37E-06	4.39E-03	2.13E-05	7.37E-06	7.68E-07	7.37E-06
	BA-140	1.28E+01	2.00E-05	1.75E-08	1.17E-06	1.17E-06	5.71E-09	4.71E-04	2.75E-05	1.17E-06
	CS-137	1.10E+04	2.45E-04	2.23E-04	3.47E-05	3.47E-05	7.63E-05	2.81E-05	9.78E-07	3.47E-05
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	2.73E-02	1.74E-03	1.74E-03	1.74E-03	1.74E-03	4.00E-03	9.28E-05	1.74E-03
	SR-89	5.20E+01	1.62E-04	4.66E-06	4.66E-06	4.66E-06	4.66E-06	5.83E-04	4.52E-05	4.66E-06
	LA-140	1.67E+00	1.74E-07	6.08E-08	2.04E-08	2.04E-08	2.04E-08	4.94E-05	6.10E-05	2.04E-08
	CE-141,144	2.84E+02	1.83E-03	5.72E-04	9.77E-05	9.77E-05	3.17E-04	3.23E-03	1.05E-04	9.77E-05
	RU103,106,BE7	3.67E+02	3.68E-05	4.57E-06	4.57E-06	4.57E-06	4.97E-05	3.87E-03	1.16E-04	4.57E-06
	ZR,NB-95	6.58E+01	5.13E-05	1.13E-05	1.00E-05	1.00E-05	1.61E-05	6.03E-04	1.65E-05	1.00E-05
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
TEEN	I-131	8.05E+00	4.43E-06	6.14E-06	3.30E-06	1.83E-03	1.05E-05	3.30E-06	8.11E-07	3.30E-06
	BA-140	1.28E+01	6.84E-06	8.38E-09	4.40E-07	4.40E-07	2.85E-09	2.55E-04	2.86E-05	4.40E-07
	CS-137	1.10E+04	8.38E-05	1.06E-04	3.89E-05	3.89E-05	3.80E-05	1.51E-05	1.06E-06	3.89E-05
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	1.35E-02	8.35E-04	8.35E-04	8.35E-04	8.35E-04	2.06E-03	9.56E-05	8.35E-04
	SR-89	5.20E+01	5.43E-05	1.56E-06	1.56E-06	1.56E-06	1.56E-06	3.02E-04	4.64E-05	1.56E-06
	LA-140	1.67E+00	5.99E-08	2.95E-08	7.82E-09	7.82E-09	7.82E-09	2.68E-05	6.09E-05	7.82E-09
	CE-141,144	2.84E+02	6.11E-04	2.53E-04	3.28E-05	3.28E-05	1.51E-04	1.67E-03	1.08E-04	3.28E-05
	RU103,106,BE7	3.67E+02	1.23E-05	1.55E-06	1.55E-06	1.55E-06	2.38E-05	2.01E-03	1.20E-04	1.55E-06
	ZR,NB-95	6.58E+01	1.82E-05	5.73E-06	3.94E-06	3.94E-06	8.42E-06	3.36E-04	1.86E-05	3.94E-06
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ADULT	I-131	8.05E+00	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.67E-06	2.56E-06	7.85E-07	2.56E-06
	BA-140	1.28E+01	4.88E-06	6.13E-09	3.21E-07	3.21E-07	2.09E-09	1.59E-04	2.73E-05	3.21E-07
	CS-137	1.10E+04	5.98E-05	7.77E-05	5.36E-05	5.36E-05	2.78E-05	9.41E-06	1.05E-06	5.36E-05
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	1.24E-02	7.62E-04	7.62E-04	7.62E-04	7.62E-04	1.20E-03	9.02E-05	7.62E-04
	SR-89	5.20E+01	3.80E-05	1.09E-06	1.09E-06	1.09E-06	1.09E-06	1.75E-04	4.37E-05	1.09E-06
	LA-140	1.67E+00	4.30E-08	2.17E-08	5.73E-09	5.73E-09	5.73E-09	1.70E-05	5.73E-05	5.73E-09
	CE-141,144	2.84E+02	4.29E-04	1.79E-04	2.30E-05	2.30E-05	1.06E-04	9.73E-04	1.02E-04	2.30E-05
	RU103,106,BE7	3.67E+02	8.64E-06	1.09E-06	1.09E-06	1.09E-06	1.67E-05	1.18E-03	1.14E-04	1.09E-06
	ZR,NB-95	6.58E+01	1.34E-05	4.30E-06	2.91E-06	2.91E-06	6.77E-06	2.22E-04	1.88E-05	2.91E-06
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01

TABLE A1 (Continued)

Pathway: Air submersion

Age	Nuclide	Halflife,d	Organ Bone	Liver	T. Body	Thyroid	Kidney	Lung	Gi-Lli	Skin
INFANT	I-131	8.05E+00	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	4.90E-07
	BA-140	1.28E+01	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	4.40E-07
	CS-137	1.10E+04	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	7.00E-07
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	1.30E-07
	SR-89	5.20E+01	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	4.90E-07
	LA-140	1.67E+00	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	2.70E-06
	CE-141,144	2.84E+02	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	1.20E-06
	RU103,106,BE7	3.67E+02	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	1.50E-06
	ZR,NB-95	6.58E+01	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	8.40E-07
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CHILD	I-131	8.05E+00	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	4.90E-07
	BA-140	1.28E+01	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	4.40E-07
	CS-137	1.10E+04	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	7.00E-07
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	1.30E-07
	SR-89	5.20E+01	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	4.90E-07
	LA-140	1.67E+00	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	2.70E-06
	CE-141,144	2.84E+02	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	1.20E-06
	RU103,106,BE7	3.67E+02	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	1.50E-06
	ZR,NB-95	6.58E+01	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	8.40E-07
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
TEEN	I-131	8.05E+00	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	4.90E-07
	BA-140	1.28E+01	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	4.40E-07
	CS-137	1.10E+04	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	7.00E-07
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	1.30E-07
	SR-89	5.20E+01	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	4.90E-07
	LA-140	1.67E+00	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	2.70E-06
	CE-141,144	2.84E+02	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	1.20E-06
	RU103,106,BE7	3.67E+02	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	1.50E-06
	ZR,NB-95	6.58E+01	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	8.40E-07
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ADULT	I-131	8.05E+00	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	3.10E-07	4.90E-07
	BA-140	1.28E+01	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	4.40E-07
	CS-137	1.10E+04	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	4.70E-07	7.00E-07
	K-40	4.60E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	SR-90	1.03E+04	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	2.40E-10	1.30E-07
	SR-89	5.20E+01	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	2.10E-09	4.90E-07
	LA-140	1.67E+00	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	1.90E-06	2.70E-06
	CE-141,144	2.84E+02	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	5.90E-08	1.20E-06
	RU103,106,BE7	3.67E+02	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	4.10E-07	1.50E-06
	ZR,NB-95	6.58E+01	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	6.80E-07	8.40E-07
	BI-214	5.85E+05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01

variant. To be precise, when an interval between successive abscissa values is over twice the length of the sum of the two adjacent intervals, the midpoint of the line segment connecting the points corresponding to these abscissa values was added to the actual data points for curve fitting purposes.

In calculating net radionuclide concentrations in milk, estimates of background concentrations were established using ERAMS data for July, August, and September (prior to September 17) 1977. These months were chosen because they immediately preceded the weapons test, and, during this period, no events had taken place in the world which would have tended to increase background levels of radionuclides in milk in the United States. Gross radionuclide concentrations for air were used for the calculations since background radionuclide levels for air were not available. The integrated radionuclide concentrations for air and milk at each location and the average integrated concentrations for each state are listed in Table A2.

A.3 Results of individual dose calculations

The doses for an individual in each age group in each state are tabulated in Table A3. These doses were calculated using the equation and methods discussed in the text.

A4. Estimation of milk consumption and population for each state

The milk production in the U.S. for the period of integration (September 17 - December 1, 1977) was calculated using USDA milk production data (DOA77) as shown in Table A4.

TABLE A2

Integrated radionuclide concentrations in milk and air

Location	Nuclide	Pathway Milk (pCi-d/liter)	Air (pCi-d/m**3)
AK:ANCHORAGE	I-131	NO DATA	0.00E-01
	BA-140	NO DATA	8.62E-03
	CS-137	NO DATA	2.69E-02
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	0.00E-01
	RU103,106,BE7	NO DATA	1.07E+00
	ZR,NB-95	NO DATA	5.35E-01
	BI-214	NO DATA	4.13E-02
AK:FAIRBANKS	I-131	NO DATA	7.10E-01
	BA-140	NO DATA	1.25E+00
	CS-137	NO DATA	6.75E-03
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	1.16E+01
	RU103,106,BE7	NO DATA	2.59E+00
	ZR,NB-95	NO DATA	9.06E-01
	BI-214	NO DATA	9.35E-02
AK:JUNEAU	I-131	NO DATA	0.00E-01
	BA-140	NO DATA	1.26E+00
	CS-137	NO DATA	2.51E-02
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	3.75E+00
	RU103,106,BE7	NO DATA	2.76E+00
	ZR,NB-95	NO DATA	2.12E+00
	BI-214	NO DATA	9.58E-03
AK:PALMER	I-131	1.99E+03	NO DATA
	BA-140	4.60E+02	NO DATA
	CS-137	2.23E+02	NO DATA
	K-40	2.97E+03	NO DATA
	SR-90	1.42E+02	NO DATA
	SR-89	3.06E+02	NO DATA
	LA-140	5.29E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA

TABLE A2 (Continued)

		Pathway	
Location	Nuclide	Milk (pCi-d/liter)	Air (pCi-d/m**3)
ALASKA	I-131	1.99E+03	2.36E-01
	BA-140	4.60E+02	8.39E-01
	CS-137	2.23E+02	1.95E-02
	K-40	2.97E+03	NO DATA
	SR-90	1.42E+02	NO DATA
	SR-89	3.06E+02	NO DATA
	LA-140	5.29E+02	NO DATA
	CE-141,144	NO DATA	5.11E+00
	RU103,106,BE7	NO DATA	2.14E+00
	ZR,NB-95	NO DATA	1.18E+00
	BI-214	NO DATA	4.81E-02
AL:MONTGOMERY	I-131	5.39E+02	6.93E-01
	BA-140	5.64E+02	2.84E+00
	CS-137	0.00E-01	0.00E-01
	K-40	1.40E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	4.51E+02	NO DATA
	LA-140	6.49E+02	NO DATA
	CE-141,144	NO DATA	1.16E+01
	RU103,106,BE7	NO DATA	1.60E+01
	ZR,NB-95	NO DATA	3.09E+00
	BI-214	NO DATA	5.77E-01
ALABAMA	I-131	5.39E+02	6.93E-01
	BA-140	5.64E+02	2.84E+00
	CS-137	0.00E-01	0.00E-01
	K-40	1.40E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	4.51E+02	NO DATA
	LA-140	6.49E+02	NO DATA
	CE-141,144	NO DATA	1.16E+01
	RU103,106,BE7	NO DATA	1.60E+01
	ZR,NB-95	NO DATA	3.09E+00
	BI-214	NO DATA	5.77E-01
AR:LITTLE ROCK	I-131	8.49E+02	1.00E+00
	BA-140	7.97E+02	3.11E+00
	CS-137	1.65E+02	0.00E-01
	K-40	5.04E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.04E+03	NO DATA
	LA-140	9.16E+02	NO DATA
	CE-141,144	NO DATA	1.22E+01
	RU103,106,BE7	NO DATA	1.19E+01
	ZR,NB-95	NO DATA	2.25E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	 Air (pCi-d/m**3)
ARKANSAS	I-131	8.49E+02	1.00E+00
	BA-140	7.97E+02	3.11E+00
	CS-137	1.65E+02	0.00E-01
	K-40	5.04E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.04E+03	NO DATA
	LA-140	9.16E+02	NO DATA
	CE-141,144	NO DATA	1.22E+01
	RU103,106,BE7	NO DATA	1.19E+01
	ZR,NB-95	NO DATA	2.25E+00
	BI-214	NO DATA	0.00E-01
AZ:PHOENIX	I-131	3.39E+02	3.42E+00
	BA-140	4.55E+02	9.08E+00
	CS-137	0.00E-01	0.00E-01
	K-40	9.47E+02	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.93E+01	NO DATA
	LA-140	5.23E+02	NO DATA
	CE-141,144	NO DATA	2.88E+01
	RU103,106,BE7	NO DATA	3.27E+01
	ZR,NB-95	NO DATA	5.60E+00
	BI-214	NO DATA	0.00E-01
ARIZONA	I-131	3.39E+02	3.42E+00
	BA-140	4.55E+02	9.08E+00
	CS-137	0.00E-01	0.00E-01
	K-40	9.47E+02	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.93E+01	NO DATA
	LA-140	5.23E+02	NO DATA
	CE-141,144	NO DATA	2.88E+01
	RU103,106,BE7	NO DATA	3.27E+01
	ZR,NB-95	NO DATA	5.60E+00
	BI-214	NO DATA	0.00E-01
CA:BERKELEY	I-131	NO DATA	2.37E-01
	BA-140	NO DATA	1.71E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	7.76E+00
	RU103,106,BE7	NO DATA	1.09E+01
	ZR,NB-95	NO DATA	2.48E+00
	BI-214	NO DATA	1.61E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
CA:LOS ANGELES	I-131	1.93E+02	8.36E-01
	BA-140	2.76E+02	3.87E+00
	CS-137	1.83E+02	0.00E-01
	K-40	8.58E+02	NO DATA
	SR-90	3.77E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	3.19E+02	NO DATA
	CE-141,144	NO DATA	1.75E+01
	RU103,106,BE7	NO DATA	2.07E+01
	ZR,NB-95	NO DATA	4.66E+00
	BI-214	NO DATA	0.00E-01
CA:SACRAMENTO	I-131	0.00E-01	NO DATA
	BA-140	6.46E+02	NO DATA
	CS-137	9.77E+01	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	3.17E+01	NO DATA
	LA-140	7.43E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
CA:SAN FRANCISCO	I-131	1.87E+02	NO DATA
	BA-140	4.92E+02	NO DATA
	CS-137	2.19E+02	NO DATA
	K-40	3.67E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.93E+01	NO DATA
	LA-140	5.66E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
CALIFORNIA	I-131	1.26E+02	5.36E-01
	BA-140	4.71E+02	2.79E+00
	CS-137	1.66E+02	0.00E-01
	K-40	1.50E+03	NO DATA
	SR-90	1.25E+01	NO DATA
	SR-89	2.03E+01	NO DATA
	LA-140	5.42E+02	NO DATA
	CE-141,144	NO DATA	1.26E+01
	RU103,106,BE7	NO DATA	1.58E+01
	ZR,NB-95	NO DATA	3.57E+00
	BI-214	NO DATA	8.05E-02

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
CO:DENVER	I-131	6.47E+02	9.94E+00
	BA-140	3.13E+02	2.34E+01
	CS-137	3.56E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	5.37E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	3.61E+02	NO DATA
	CE-141,144	NO DATA	7.48E+01
	RU103,106,BE7	NO DATA	7.02E+01
	ZR,NB-95	NO DATA	1.14E+01
	BI-214	NO DATA	0.00E-01
COLORADO	I-131	6.47E+02	9.94E+00
	BA-140	3.13E+02	2.34E+01
	CS-137	3.56E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	5.37E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	3.61E+02	NO DATA
	CE-141,144	NO DATA	7.48E+01
	RU103,106,BE7	NO DATA	7.02E+01
	ZR,NB-95	NO DATA	1.14E+01
	BI-214	NO DATA	0.00E-01
CT:HARTFORD	I-131	3.25E+02	3.18E-01
	BA-140	4.94E+02	1.15E+00
	CS-137	1.05E+02	0.00E-01
	K-40	3.57E+02	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	3.10E+02	NO DATA
	LA-140	5.68E+02	NO DATA
	CE-141,144	NO DATA	1.35E+00
	RU103,106,BE7	NO DATA	3.81E+00
	ZR,NB-95	NO DATA	8.61E-01
	BI-214	NO DATA	0.00E-01
CONNECTICUT	I-131	3.25E+02	3.18E-01
	BA-140	4.94E+02	1.15E+00
	CS-137	1.05E+02	0.00E-01
	K-40	3.57E+02	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	3.10E+02	NO DATA
	LA-140	5.68E+02	NO DATA
	CE-141,144	NO DATA	1.35E+00
	RU103,106,BE7	NO DATA	3.81E+00
	ZR,NB-95	NO DATA	8.61E-01
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
DC:WASHINGTON	I-131	5.77E+02	1.55E+00
	BA-140	3.40E+02	3.21E+00
	CS-137	1.38E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	4.49E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	3.92E+02	NO DATA
	CE-141,144	NO DATA	6.66E+00
	RU103,106,BE7	NO DATA	6.17E+00
	ZR,NB-95	NO DATA	5.04E-01
	BI-214	NO DATA	0.00E-01
D.C.	I-131	5.77E+02	1.55E+00
	BA-140	3.40E+02	3.21E+00
	CS-137	1.38E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	4.49E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	3.92E+02	NO DATA
	CE-141,144	NO DATA	6.66E+00
	RU103,106,BE7	NO DATA	6.17E+00
	ZR,NB-95	NO DATA	5.04E-01
	BI-214	NO DATA	0.00E-01
DE:WILMINGTON	I-131	5.56E+02	5.94E-01
	BA-140	7.08E+02	2.15E+00
	CS-137	5.04E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.26E+02	NO DATA
	LA-140	8.13E+02	NO DATA
	CE-141,144	NO DATA	3.16E+00
	RU103,106,BE7	NO DATA	5.94E+00
	ZR,NB-95	NO DATA	8.94E-01
	BI-214	NO DATA	0.00E-01
DELAWARE	I-131	5.56E+02	5.94E-01
	BA-140	7.08E+02	2.15E+00
	CS-137	5.04E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.26E+02	NO DATA
	LA-140	8.13E+02	NO DATA
	CE-141,144	NO DATA	3.16E+00
	RU103,106,BE7	NO DATA	5.94E+00
	ZR,NB-95	NO DATA	8.94E-01
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	 Air (pCi-d/m**3)
FL:JACKSONVILLE	I-131	NO DATA	1.58E+00
	BA-140	NO DATA	4.96E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	2.25E+01
	RU103,106,BE7	NO DATA	1.92E+01
	ZR,NB-95	NO DATA	3.58E+00
	BI-214	NO DATA	0.00E-01
FL:MIAMI	I-131	NO DATA	2.56E+00
	BA-140	NO DATA	7.93E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	3.51E+01
	RU103,106,BE7	NO DATA	3.03E+01
	ZR,NB-95	NO DATA	5.12E+00
	BI-214	NO DATA	0.00E-01
FL:TAMPA	I-131	4.46E+02	NO DATA
	BA-140	3.62E+02	NO DATA
	CS-137	0.00E-01	NO DATA
	K-40	1.01E+03	NO DATA
	SR-90	5.13E+01	NO DATA
	SR-89	1.09E+01	NO DATA
	LA-140	4.16E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
FLORIDA	I-131	4.46E+02	2.07E+00
	BA-140	3.62E+02	6.44E+00
	CS-137	0.00E-01	0.00E-01
	K-40	1.01E+03	NO DATA
	SR-90	5.13E+01	NO DATA
	SR-89	1.09E+01	NO DATA
	LA-140	4.16E+02	NO DATA
	CE-141,144	NO DATA	2.88E+01
	RU103,106,BE7	NO DATA	2.47E+01
	ZR,NB-95	NO DATA	4.35E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	 Air (pCi-d/m**3)
GA:ATLANTA	I-131	2.25E+02	5.26E+00
	BA-140	5.07E+02	1.31E+01
	CS-137	0.00E-01	0.00E-01
	K-40	4.99E+02	NO DATA
	SR-90	1.49E+01	NO DATA
	SR-89	1.32E+02	NO DATA
	LA-140	5.83E+02	NO DATA
	CE-141,144	NO DATA	3.21E+01
	RU103,106,BE7	NO DATA	4.09E+01
	ZR,NB-95	NO DATA	3.71E+00
	BI-214	NO DATA	0.00E-01
GEORGIA	I-131	2.25E+02	5.26E+00
	BA-140	5.07E+02	1.31E+01
	CS-137	0.00E-01	0.00E-01
	K-40	4.99E+02	NO DATA
	SR-90	1.49E+01	NO DATA
	SR-89	1.32E+02	NO DATA
	LA-140	5.83E+02	NO DATA
	CE-141,144	NO DATA	3.21E+01
	RU103,106,BE7	NO DATA	4.09E+01
	ZR,NB-95	NO DATA	3.71E+00
	BI-214	NO DATA	0.00E-01
HI:HONOLULU	I-131	2.39E+02	2.85E+00
	BA-140	1.66E+02	7.89E+00
	CS-137	8.14E+01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.38E+02	NO DATA
	LA-140	1.89E+02	NO DATA
	CE-141,144	NO DATA	1.18E+00
	RU103,106,BE7	NO DATA	2.50E+01
	ZR,NB-95	NO DATA	2.82E+00
	BI-214	NO DATA	0.00E-01
HAWAII	I-131	2.39E+02	2.85E+00
	BA-140	1.66E+02	7.89E+00
	CS-137	8.14E+01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.38E+02	NO DATA
	LA-140	1.89E+02	NO DATA
	CE-141,144	NO DATA	1.18E+00
	RU103,106,BE7	NO DATA	2.50E+01
	ZR,NB-95	NO DATA	2.82E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	Air (pCi-d/m**3)
IA:DES MOINES	I-131	1.45E+03	NO DATA
	BA-140	2.72E+02	NO DATA
	CS-137	2.07E+02	NO DATA
	K-40	1.52E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	7.25E+02	NO DATA
	LA-140	3.13E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
IA:IOWA CITY	I-131	NO DATA	6.25E-01
	BA-140	NO DATA	1.74E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	5.62E+00
	RU103,106,BE7	NO DATA	7.12E+00
	ZR,NB-95	NO DATA	1.61E+00
	BI-214	NO DATA	0.00E-01
IOWA	I-131	1.45E+03	6.25E-01
	BA-140	2.72E+02	1.74E+00
	CS-137	2.07E+02	0.00E-01
	K-40	1.52E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	7.25E+02	NO DATA
	LA-140	3.13E+02	NO DATA
	CE-141,144	NO DATA	5.62E+00
	RU103,106,BE7	NO DATA	7.12E+00
	ZR,NB-95	NO DATA	1.61E+00
	BI-214	NO DATA	0.00E-01
ID:BOISE	I-131	NO DATA	9.83E-01
	BA-140	NO DATA	2.56E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	1.33E+01
	RU103,106,BE7	NO DATA	8.44E+00
	ZR,NB-95	NO DATA	2.28E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	 Air (pCi-d/m**3)
ID:IDAHO FALLS	I-131	7.21E+02	6.38E+00
	BA-140	4.31E+02	1.39E+01
	CS-137	2.40E+02	0.00E-01
	K-40	1.13E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	6.07E+01	NO DATA
	LA-140	4.96E+02	NO DATA
	CE-141,144	NO DATA	3.81E+01
	RU103,106,BE7	NO DATA	4.33E+01
	ZR,NB-95	NO DATA	9.77E+00
	BI-214	NO DATA	0.00E-01
IDAHO	I-131	7.21E+02	3.68E+00
	BA-140	4.31E+02	8.23E+00
	CS-137	2.40E+02	0.00E-01
	K-40	1.13E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	6.07E+01	NO DATA
	LA-140	4.96E+02	NO DATA
	CE-141,144	NO DATA	2.57E+01
	RU103,106,BE7	NO DATA	2.58E+01
	ZR,NB-95	NO DATA	6.02E+00
	BI-214	NO DATA	0.00E-01
IL:CHICAGO	I-131	1.25E+03	NO DATA
	BA-140	7.09E+02	NO DATA
	CS-137	2.11E+02	NO DATA
	K-40	1.78E+02	NO DATA
	SR-90	1.56E+02	NO DATA
	SR-89	5.00E+02	NO DATA
	LA-140	8.16E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
IL:WHEATON	I-131	NO DATA	1.52E-02
	BA-140	NO DATA	9.04E-01
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	3.65E+00
	RU103,106,BE7	NO DATA	4.02E+00
	ZR,NB-95	NO DATA	8.52E-01
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	Air (pCi-d/m**3)
ILLINOIS	I-131	1.25E+03	1.52E-02
	BA-140	7.09E+02	9.04E-01
	CS-137	2.11E+02	0.00E-01
	K-40	1.78E+02	NO DATA
	SR-90	1.56E+02	NO DATA
	SR-89	5.00E+02	NO DATA
	LA-140	8.16E+02	NO DATA
	CE-141,144	NO DATA	3.65E+00
	RU103,106,BE7	NO DATA	4.02E+00
	ZR,NB-95	NO DATA	8.52E-01
	BI-214	NO DATA	0.00E-01
IN:INDIANAPOLIS	I-131	1.07E+03	6.29E-01
	BA-140	4.91E+02	2.10E+00
	CS-137	5.54E+01	0.00E-01
	K-40	3.42E+03	NO DATA
	SR-90	5.73E+01	NO DATA
	SR-89	3.75E+02	NO DATA
	LA-140	5.64E+02	NO DATA
	CE-141,144	NO DATA	1.17E+01
	RU103,106,BE7	NO DATA	1.27E+01
	ZR,NB-95	NO DATA	3.21E+00
	BI-214	NO DATA	0.00E-01
INDIANA	I-131	1.07E+03	6.29E-01
	BA-140	4.91E+02	2.10E+00
	CS-137	5.54E+01	0.00E-01
	K-40	3.42E+03	NO DATA
	SR-90	5.73E+01	NO DATA
	SR-89	3.75E+02	NO DATA
	LA-140	5.64E+02	NO DATA
	CE-141,144	NO DATA	1.17E+01
	RU103,106,BE7	NO DATA	1.27E+01
	ZR,NB-95	NO DATA	3.21E+00
	BI-214	NO DATA	0.00E-01
KS:TOPEKA	I-131	NO DATA	1.26E+00
	BA-140	NO DATA	2.72E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	9.68E+00
	RU103,106,BE7	NO DATA	8.48E+00
	ZR,NB-95	NO DATA	1.99E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	Air (pCi-d/m**3)
KS:WICHITA	I-131	4.91E+02	NO DATA
	BA-140	3.68E+02	NO DATA
	CS-137	2.50E+02	NO DATA
	K-40	9.39E+02	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	3.16E+02	NO DATA
	LA-140	4.23E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
KANSAS	I-131	4.91E+02	1.26E+00
	BA-140	3.68E+02	2.72E+00
	CS-137	2.50E+02	0.00E-01
	K-40	9.39E+02	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	3.16E+02	NO DATA
	LA-140	4.23E+02	NO DATA
	CE-141,144	NO DATA	9.68E+00
	RU103,106,BE7	NO DATA	8.48E+00
	ZR,NB-95	NO DATA	1.99E+00
	BI-214	NO DATA	0.00E-01
KY:FRANKFORT	I-131	NO DATA	3.62E-01
	BA-140	NO DATA	1.26E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	5.18E+00
	RU103,106,BE7	NO DATA	6.04E+00
	ZR,NB-95	NO DATA	1.74E+00
	BI-214	NO DATA	0.00E-01
KY:LOUISVILLE	I-131	9.49E+02	NO DATA
	BA-140	6.10E+02	NO DATA
	CS-137	3.21E+02	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	4.84E+01	NO DATA
	SR-89	4.45E+02	NO DATA
	LA-140	7.01E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
KENTUCKY	I-131	9.49E+02	3.62E-01
	BA-140	6.10E+02	1.26E+00
	CS-137	3.21E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	4.84E+01	NO DATA
	SR-89	4.45E+02	NO DATA
	LA-140	7.01E+02	NO DATA
	CE-141,144	NO DATA	5.18E+00
	RU103,106,BE7	NO DATA	6.04E+00
	ZR,NB-95	NO DATA	1.74E+00
	BI-214	NO DATA	0.00E-01
LA:NEW ORLEANS	I-131	4.28E+02	2.25E-01
	BA-140	1.61E+02	2.93E+00
	CS-137	0.00E-01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	1.87E+02	NO DATA
	CE-141,144	NO DATA	7.86E+00
	RU103,106,BE7	NO DATA	1.25E+01
	ZR,NB-95	NO DATA	2.30E+00
	BI-214	NO DATA	0.00E-01
LOUISIANA	I-131	4.28E+02	2.25E-01
	BA-140	1.61E+02	2.93E+00
	CS-137	0.00E-01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	1.87E+02	NO DATA
	CE-141,144	NO DATA	7.86E+00
	RU103,106,BE7	NO DATA	1.25E+01
	ZR,NB-95	NO DATA	2.30E+00
	BI-214	NO DATA	0.00E-01
MA:BOSTON	I-131	6.50E+02	NO DATA
	BA-140	2.35E+02	NO DATA
	CS-137	1.97E+02	NO DATA
	K-40	2.71E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.68E+02	NO DATA
	LA-140	2.70E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
MA:LAWRENCE	I-131	NO DATA	2.72E-01
	BA-140	NO DATA	1.44E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	5.66E+00
	RU103,106,BE7	NO DATA	5.76E+00
	ZR,NB-95	NO DATA	1.90E+00
	BI-214	NO DATA	0.00E-01
MASSACHUSETTS	I-131	6.50E+02	2.72E-01
	BA-140	2.35E+02	1.44E+00
	CS-137	1.97E+02	0.00E-01
	K-40	2.71E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.68E+02	NO DATA
	LA-140	2.70E+02	NO DATA
	CE-141,144	NO DATA	5.66E+00
	RU103,106,BE7	NO DATA	5.76E+00
	ZR,NB-95	NO DATA	1.90E+00
	BI-214	NO DATA	0.00E-01
MD:BALTIMORE	I-131	4.87E+02	1.55E+00
	BA-140	4.41E+01	3.21E+00
	CS-137	1.43E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.74E+02	NO DATA
	LA-140	5.17E+01	NO DATA
	CE-141,144	NO DATA	6.66E+00
	RU103,106,BE7	NO DATA	6.17E+00
	ZR,NB-95	NO DATA	5.04E-01
	BI-214	NO DATA	0.00E-01
MARYLAND	I-131	4.87E+02	1.55E+00
	BA-140	4.41E+01	3.21E+00
	CS-137	1.43E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.74E+02	NO DATA
	LA-140	5.17E+01	NO DATA
	CE-141,144	NO DATA	6.66E+00
	RU103,106,BE7	NO DATA	6.17E+00
	ZR,NB-95	NO DATA	5.04E-01
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
ME:AUGUSTA	I-131	NO DATA	3.44E-01
	BA-140	NO DATA	9.12E-01
	CS-137	NO DATA	2.55E-03
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	4.70E+00
	RU103,106,BE7	NO DATA	2.53E+00
	ZR,NB-95	NO DATA	1.43E+00
	BI-214	NO DATA	9.57E-02
ME:PORTLAND	I-131	4.81E+02	NO DATA
	BA-140	1.16E+03	NO DATA
	CS-137	0.00E-01	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.90E+02	NO DATA
	LA-140	1.33E+03	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
MAINE	I-131	4.81E+02	3.44E-01
	BA-140	1.16E+03	9.12E-01
	CS-137	0.00E-01	2.55E-03
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.90E+02	NO DATA
	LA-140	1.33E+03	NO DATA
	CE-141,144	NO DATA	4.70E+00
	RU103,106,BE7	NO DATA	2.53E+00
	ZR,NB-95	NO DATA	1.43E+00
	BI-214	NO DATA	9.57E-02
MI:DETROIT	I-131	1.20E+03	NO DATA
	BA-140	6.54E+02	NO DATA
	CS-137	2.36E+02	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	8.44E+01	NO DATA
	SR-89	4.69E+02	NO DATA
	LA-140	7.52E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
MI:GRAND RAPIDS	I-131	9.26E+02	NO DATA
	BA-140	3.99E+02	NO DATA
	CS-137	0.00E-01	NO DATA
	K-40	1.59E+03	NO DATA
	SR-90	1.38E+02	NO DATA
	SR-89	6.78E+02	NO DATA
	LA-140	4.60E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
MI:LANSING	I-131	NO DATA	7.48E-01
	BA-140	NO DATA	2.84E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	1.06E+01
	RU103,106,BE7	NO DATA	1.24E+01
	ZR,NB-95	NO DATA	2.41E+00
	BI-214	NO DATA	0.00E-01
MICHIGAN	I-131	1.06E+03	7.48E-01
	BA-140	5.26E+02	2.84E+00
	CS-137	1.18E+02	0.00E-01
	K-40	7.95E+02	NO DATA
	SR-90	1.11E+02	NO DATA
	SR-89	5.73E+02	NO DATA
	LA-140	6.06E+02	NO DATA
	CE-141,144	NO DATA	1.06E+01
	RU103,106,BE7	NO DATA	1.24E+01
	ZR,NB-95	NO DATA	2.41E+00
	BI-214	NO DATA	0.00E-01
MN:MINNEAPOLIS	I-131	1.68E+03	2.39E-01
	BA-140	5.05E+02	1.60E+00
	CS-137	2.87E+02	8.94E-03
	K-40	2.67E+03	NO DATA
	SR-90	1.96E+02	NO DATA
	SR-89	3.15E+02	NO DATA
	LA-140	5.82E+02	NO DATA
	CE-141,144	NO DATA	3.51E+00
	RU103,106,BE7	NO DATA	3.84E+00
	ZR,NB-95	NO DATA	1.34E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
MINNESOTA	I-131	1.68E+03	2.39E-01
	BA-140	5.05E+02	1.60E+00
	CS-137	2.87E+02	8.94E-03
	K-40	2.67E+03	NO DATA
	SR-90	1.96E+02	NO DATA
	SR-89	3.15E+02	NO DATA
	LA-140	5.82E+02	NO DATA
	CE-141,144	NO DATA	3.51E+00
	RU103,106,BE7	NO DATA	3.84E+00
	ZR,NB-95	NO DATA	1.34E+00
	BI-214	NO DATA	0.00E-01
MO:JEFFERSON CI	I-131	NO DATA	4.25E-01
	BA-140	NO DATA	2.73E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	6.36E+00
	RU103,106,BE7	NO DATA	1.02E+01
	ZR,NB-95	NO DATA	2.77E+00
	BI-214	NO DATA	0.00E-01
MO:KANSAS CITY	I-131	4.64E+02	NO DATA
	BA-140	3.62E+02	NO DATA
	CS-137	3.97E+01	NO DATA
	K-40	4.31E+02	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.70E+02	NO DATA
	LA-140	4.17E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
MO:ST. LOUIS	I-131	7.50E+02	NO DATA
	BA-140	5.34E+02	NO DATA
	CS-137	0.00E-01	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	8.59E+01	NO DATA
	SR-89	4.16E+02	NO DATA
	LA-140	6.14E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
MISSOURI	I-131	6.07E+02	4.25E-01
	BA-140	4.48E+02	2.73E+00
	CS-137	1.98E+01	0.00E-01
	K-40	2.15E+02	NO DATA
	SR-90	4.29E+01	NO DATA
	SR-89	2.93E+02	NO DATA
	LA-140	5.15E+02	NO DATA
	CE-141,144	NO DATA	6.36E+00
	RU103,106,BE7	NO DATA	1.02E+01
	ZR,NB-95	NO DATA	2.77E+00
	BI-214	NO DATA	0.00E-01
MS:JACKSON	I-131	8.10E+02	6.05E-01
	BA-140	7.26E+02	2.21E+00
	CS-137	0.00E-01	0.00E-01
	K-40	2.10E+00	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	9.16E+02	NO DATA
	LA-140	8.34E+02	NO DATA
	CE-141,144	NO DATA	6.33E+00
	RU103,106,BE7	NO DATA	8.68E+00
	ZR,NB-95	NO DATA	1.78E+00
	BI-214	NO DATA	0.00E-01
MISSISSIPPI	I-131	8.10E+02	6.05E-01
	BA-140	7.26E+02	2.21E+00
	CS-137	0.00E-01	0.00E-01
	K-40	2.10E+00	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	9.16E+02	NO DATA
	LA-140	8.34E+02	NO DATA
	CE-141,144	NO DATA	6.33E+00
	RU103,106,BE7	NO DATA	8.68E+00
	ZR,NB-95	NO DATA	1.78E+00
	BI-214	NO DATA	0.00E-01
MT:HELENA	I-131	9.48E+02	6.92E-01
	BA-140	4.18E+02	1.97E+00
	CS-137	2.30E+02	0.00E-01
	K-40	5.77E+01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.59E+02	NO DATA
	LA-140	4.81E+02	NO DATA
	CE-141,144	NO DATA	8.84E+00
	RU103,106,BE7	NO DATA	1.15E+01
	ZR,NB-95	NO DATA	2.85E+00
	BI-214	NO DATA	7.26E-03

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	Air (pCi-d/m**3)
MONTANA	I-131	9.48E+02	6.92E-01
	BA-140	4.18E+02	1.97E+00
	CS-137	2.30E+02	0.00E-01
	K-40	5.77E+01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.59E+02	NO DATA
	LA-140	4.81E+02	NO DATA
	CE-141,144	NO DATA	8.84E+00
	RU103,106,BE7	NO DATA	1.15E+01
	ZR,NB-95	NO DATA	2.85E+00
	BI-214	NO DATA	7.26E-03
NC:CHARLOTTE	I-131	4.68E+02	1.42E-01
	BA-140	2.08E+02	9.19E-01
	CS-137	2.49E+01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.22E+01	NO DATA
	LA-140	2.38E+02	NO DATA
	CE-141,144	NO DATA	0.00E-01
	RU103,106,BE7	NO DATA	3.97E+00
	ZR,NB-95	NO DATA	9.61E-01
	BI-214	NO DATA	0.00E-01
NC:WILMINGTON	I-131	NO DATA	1.68E-01
	BA-140	NO DATA	1.12E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	4.95E+00
	RU103,106,BE7	NO DATA	5.65E+00
	ZR,NB-95	NO DATA	9.59E-01
	BI-214	NO DATA	2.20E-01
NORTH CAROLINA	I-131	4.68E+02	1.55E-01
	BA-140	2.08E+02	1.01E+00
	CS-137	2.49E+01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.22E+01	NO DATA
	LA-140	2.38E+02	NO DATA
	CE-141,144	NO DATA	2.47E+00
	RU103,106,BE7	NO DATA	4.81E+00
	ZR,NB-95	NO DATA	9.60E-01
	BI-214	NO DATA	1.10E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
ND:BISMARK	I-131	NO DATA	3.35E-01
	BA-140	NO DATA	1.75E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	8.07E+00
	RU103,106,BE7	NO DATA	9.39E+00
	ZR,NB-95	NO DATA	2.73E+00
	BI-214	NO DATA	3.44E-02
ND:MINOT	I-131	2.82E+02	NO DATA
	BA-140	3.21E+02	NO DATA
	CS-137	2.23E+02	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	3.85E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	3.69E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
NORTH DAKOTA	I-131	2.82E+02	3.35E-01
	BA-140	3.21E+02	1.75E+00
	CS-137	2.23E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	3.85E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	3.69E+02	NO DATA
	CE-141,144	NO DATA	8.07E+00
	RU103,106,BE7	NO DATA	9.39E+00
	ZR,NB-95	NO DATA	2.73E+00
	BI-214	NO DATA	3.44E-02
NE:LINCOLN	I-131	NO DATA	2.47E-01
	BA-140	NO DATA	2.32E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	9.26E+00
	RU103,106,BE7	NO DATA	9.59E+00
	ZR,NB-95	NO DATA	2.13E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
NE:OMAHA	I-131	3.10E+02	NO DATA
	BA-140	5.48E+02	NO DATA
	CS-137	9.89E+01	NO DATA
	K-40	1.56E+04	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.85E+02	NO DATA
	LA-140	6.30E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
NEBRASKA	I-131	3.10E+02	2.47E-01
	BA-140	5.48E+02	2.32E+00
	CS-137	9.89E+01	0.00E-01
	K-40	1.56E+04	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.85E+02	NO DATA
	LA-140	6.30E+02	NO DATA
	CE-141,144	NO DATA	9.26E+00
	RU103,106,BE7	NO DATA	9.59E+00
	ZR,NB-95	NO DATA	2.13E+00
	BI-214	NO DATA	0.00E-01
NH:MANCHESTER	I-131	5.65E+02	3.44E-01
	BA-140	3.58E+02	9.12E-01
	CS-137	1.68E+02	2.55E-03
	K-40	1.22E+03	NO DATA
	SR-90	1.19E+02	NO DATA
	SR-89	8.63E+00	NO DATA
	LA-140	4.12E+02	NO DATA
	CE-141,144	NO DATA	4.70E+00
	RU103,106,BE7	NO DATA	2.53E+00
	ZR,NB-95	NO DATA	1.43E+00
	BI-214	NO DATA	9.57E-02
NEW HAMPSHIRE	I-131	5.65E+02	3.44E-01
	BA-140	3.58E+02	9.12E-01
	CS-137	1.68E+02	2.55E-03
	K-40	1.22E+03	NO DATA
	SR-90	1.19E+02	NO DATA
	SR-89	8.63E+00	NO DATA
	LA-140	4.12E+02	NO DATA
	CE-141,144	NO DATA	4.70E+00
	RU103,106,BE7	NO DATA	2.53E+00
	ZR,NB-95	NO DATA	1.43E+00
	BI-214	NO DATA	9.57E-02

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	Air (pCi-d/m**3)
NJ:TRENTON	I-131	6.98E+02	2.51E-01
	BA-140	2.79E+02	1.60E+00
	CS-137	1.60E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.34E+02	NO DATA
	LA-140	3.20E+02	NO DATA
	CE-141,144	NO DATA	3.59E+00
	RU103,106,BE7	NO DATA	5.28E+00
	ZR,NB-95	NO DATA	8.45E-01
	BI-214	NO DATA	0.00E-01
NEW JERSEY	I-131	6.98E+02	2.51E-01
	BA-140	2.79E+02	1.60E+00
	CS-137	1.60E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.34E+02	NO DATA
	LA-140	3.20E+02	NO DATA
	CE-141,144	NO DATA	3.59E+00
	RU103,106,BE7	NO DATA	5.28E+00
	ZR,NB-95	NO DATA	8.45E-01
	BI-214	NO DATA	0.00E-01
NM:ALBUQUERQUE	I-131	3.10E+02	NO DATA
	BA-140	1.94E+02	NO DATA
	CS-137	0.00E-01	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	2.19E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	2.22E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
NM:SANTA FE	I-131	NO DATA	0.00E-01
	BA-140	NO DATA	1.66E+01
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	4.89E+01
	RU103,106,BE7	NO DATA	8.44E+01
	ZR,NB-95	NO DATA	1.51E+01
	BI-214	NO DATA	3.89E+01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
NEW MEXICO	I-131	3.10E+02	0.00E-01
	BA-140	1.94E+02	1.66E+01
	CS-137	0.00E-01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	2.19E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	2.22E+02	NO DATA
	CE-141,144	NO DATA	4.89E+01
	RU103,106,BE7	NO DATA	8.44E+01
	ZR,NB-95	NO DATA	1.51E+01
	BI-214	NO DATA	3.89E+01
NV:LAS VEGAS	I-131	1.18E+02	9.70E+00
	BA-140	6.06E+01	2.03E+01
	CS-137	1.71E+01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	1.00E-01	NO DATA
	SR-89	3.00E+00	NO DATA
	LA-140	7.00E+01	NO DATA
	CE-141,144	NO DATA	5.06E+01
	RU103,106,BE7	NO DATA	6.13E+01
	ZR,NB-95	NO DATA	1.50E+01
	BI-214	NO DATA	0.00E-01
NEVADA	I-131	1.18E+02	9.70E+00
	BA-140	6.06E+01	2.03E+01
	CS-137	1.71E+01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	1.00E-01	NO DATA
	SR-89	3.00E+00	NO DATA
	LA-140	7.00E+01	NO DATA
	CE-141,144	NO DATA	5.06E+01
	RU103,106,BE7	NO DATA	6.13E+01
	ZR,NB-95	NO DATA	1.50E+01
	BI-214	NO DATA	0.00E-01
NY:ALBANY	I-131	NO DATA	5.44E-01
	BA-140	NO DATA	1.28E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	2.90E+00
	RU103,106,BE7	NO DATA	3.01E+00
	ZR,NB-95	NO DATA	7.55E-01
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

		Pathway	
Location	Nuclide	Milk (pCi-d/liter)	Air (pCi-d/m**3)
NY:BUFFALO	I-131	8.84E+02	NO DATA
	BA-140	2.53E+02	NO DATA
	CS-137	3.64E+02	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	4.90E+01	NO DATA
	SR-89	4.16E+02	NO DATA
	LA-140	2.92E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
NY:NEW YORK	I-131	1.03E+03	2.78E-01
	BA-140	6.45E+02	1.61E+00
	CS-137	2.23E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	5.33E+02	NO DATA
	LA-140	7.42E+02	NO DATA
	CE-141,144	NO DATA	6.36E+00
	RU103,106,BE7	NO DATA	8.27E+00
	ZR,NB-95	NO DATA	1.86E+00
	BI-214	NO DATA	0.00E-00
NY:NIAGARA FALL	I-131	NO DATA	0.00E-01
	BA-140	NO DATA	1.61E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	2.71E+00
	RU103,106,BE7	NO DATA	6.52E+00
	ZR,NB-95	NO DATA	2.03E+00
	BI-214	NO DATA	0.00E-00
NY:SYRACUSE	I-131	6.95E+02	5.08E-01
	BA-140	2.44E+02	1.68E+00
	CS-137	1.48E+02	0.00E-01
	K-40	3.80E+03	NO DATA
	SR-90	6.36E+01	NO DATA
	SR-89	1.44E+02	NO DATA
	LA-140	2.82E+02	NO DATA
	CE-141,144	NO DATA	4.38E+00
	RU103,106,BE7	NO DATA	5.39E+00
	ZR,NB-95	NO DATA	1.38E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
NEW YORK	I-131	8.69E+02	3.32E-01
	BA-140	3.80E+02	1.54E+00
	CS-137	2.45E+02	0.00E-01
	K-40	1.26E+03	NO DATA
	SR-90	3.75E+01	NO DATA
	SR-89	3.64E+02	NO DATA
	LA-140	4.38E+02	NO DATA
	CE-141,144	NO DATA	4.08E+00
	RU103,106,BE7	NO DATA	5.79E+00
	ZR,NB-95	NO DATA	1.50E+00
	BI-214	NO DATA	0.00E-00
OH:CINCINNATI	I-131	9.20E+02	NO DATA
	BA-140	3.77E+02	NO DATA
	CS-137	8.79E+01	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	3.99E+02	NO DATA
	LA-140	4.34E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
OH:CLEVELAND	I-131	7.79E+02	NO DATA
	BA-140	2.53E+02	NO DATA
	CS-137	2.57E+02	NO DATA
	K-40	6.26E+02	NO DATA
	SR-90	5.47E+01	NO DATA
	SR-89	1.66E+02	NO DATA
	LA-140	2.91E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
OH:COLUMBUS	I-131	NO DATA	6.29E-01
	BA-140	NO DATA	2.10E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	1.17E+01
	RU103,106,BE7	NO DATA	1.27E+01
	ZR,NB-95	NO DATA	3.21E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
OH:PAINESVILLE	I-131	NO DATA	8.99E-01
	BA-140	NO DATA	1.82E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	7.48E+00
	RU103,106,BE7	NO DATA	6.89E+00
	ZR,NB-95	NO DATA	1.56E+00
	BI-214	NO DATA	1.17E-02
OHIO	I-131	8.49E+02	7.64E-01
	BA-140	3.15E+02	1.96E+00
	CS-137	1.72E+02	0.00E-01
	K-40	3.13E+02	NO DATA
	SR-90	2.73E+01	NO DATA
	SR-89	2.82E+02	NO DATA
	LA-140	3.62E+02	NO DATA
	CE-141,144	NO DATA	9.59E+00
	RU103,106,BE7	NO DATA	9.79E+00
	ZR,NB-95	NO DATA	2.38E+00
	BI-214	NO DATA	5.85E-03
OK:OKLAHOMA CITY	I-131	1.05E+02	4.78E-01
	BA-140	6.89E+01	1.80E+00
	CS-137	1.68E+02	0.00E-01
	K-40	6.81E+03	NO DATA
	SR-90	9.97E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	7.78E+01	NO DATA
	CE-141,144	NO DATA	5.56E+00
	RU103,106,BE7	NO DATA	7.78E+00
	ZR,NB-95	NO DATA	1.83E+00
	BI-214	NO DATA	0.00E-01
OKLAHOMA	I-131	1.05E+02	4.78E-01
	BA-140	6.89E+01	1.80E+00
	CS-137	1.68E+02	0.00E-01
	K-40	6.81E+03	NO DATA
	SR-90	9.97E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	7.78E+01	NO DATA
	CE-141,144	NO DATA	5.56E+00
	RU103,106,BE7	NO DATA	7.78E+00
	ZR,NB-95	NO DATA	1.83E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
OR:PORTLAND	I-131	4.39E+02	1.25E-01
	BA-140	6.30E+02	9.65E-01
	CS-137	5.44E+00	2.00E-02
	K-40	0.00E-01	NO DATA
	SR-90	5.29E+01	NO DATA
	SR-89	2.09E+02	NO DATA
	LA-140	7.25E+02	NO DATA
	CE-141,144	NO DATA	3.58E+00
	RU103,106,BE7	NO DATA	5.70E+00
	ZR,NB-95	NO DATA	1.63E+00
	BI-214	NO DATA	1.89E-01
OREGON	I-131	4.39E+02	1.25E-01
	BA-140	6.30E+02	9.65E-01
	CS-137	5.44E+00	2.00E-02
	K-40	0.00E-01	NO DATA
	SR-90	5.29E+01	NO DATA
	SR-89	2.09E+02	NO DATA
	LA-140	7.25E+02	NO DATA
	CE-141,144	NO DATA	3.58E+00
	RU103,106,BE7	NO DATA	5.70E+00
	ZR,NB-95	NO DATA	1.63E+00
	BI-214	NO DATA	1.89E-01
PA:HARRISBURG	I-131	NO DATA	5.41E-01
	BA-140	NO DATA	2.41E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	7.17E+00
	RU103,106,BE7	NO DATA	9.47E+00
	ZR,NB-95	NO DATA	2.44E+00
	BI-214	NO DATA	0.00E-01
PA:PHILADELPHIA	I-131	6.35E+02	NO DATA
	BA-140	0.00E-01	NO DATA
	CS-137	1.83E+02	NO DATA
	K-40	1.10E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.13E+02	NO DATA
	LA-140	0.00E-01	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
PA:PITTSBURGH	I-131	7.72E+02	0.00E-01
	BA-140	1.30E+02	1.74E+01
	CS-137	4.04E+02	2.28E-01
	K-40	5.02E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	3.17E+02	NO DATA
	LA-140	1.50E+02	NO DATA
	CE-141,144	NO DATA	0.00E-01
	RU103,106,BE7	NO DATA	0.00E-01
	ZR,NB-95	NO DATA	2.00E+00
	BI-214	NO DATA	1.83E+01
PENNSYLVANIA	I-131	7.03E+02	2.70E-01
	BA-140	6.50E+01	9.90E+00
	CS-137	2.93E+02	1.14E-01
	K-40	3.06E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.15E+02	NO DATA
	LA-140	7.50E+01	NO DATA
	CE-141,144	NO DATA	3.58E+00
	RU103,106,BE7	NO DATA	4.73E+00
	ZR,NB-95	NO DATA	2.22E+00
	BI-214	NO DATA	9.15E+00
RI:PROVIDENCE	I-131	6.19E+02	4.04E-01
	BA-140	5.31E+02	1.23E+00
	CS-137	1.01E+02	0.00E-01
	K-40	5.62E+02	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	5.22E+02	NO DATA
	LA-140	6.11E+02	NO DATA
	CE-141,144	NO DATA	4.79E+00
	RU103,106,BE7	NO DATA	5.44E+00
	ZR,NB-95	NO DATA	1.19E+00
	BI-214	NO DATA	0.00E-01
RHODE ISLAND	I-131	6.19E+02	4.04E-01
	BA-140	5.31E+02	1.23E+00
	CS-137	1.01E+02	0.00E-01
	K-40	5.62E+02	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	5.22E+02	NO DATA
	LA-140	6.11E+02	NO DATA
	CE-141,144	NO DATA	4.79E+00
	RU103,106,BE7	NO DATA	5.44E+00
	ZR,NB-95	NO DATA	1.19E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
SC:CHARLESTON	I-131	5.65E+02	NO DATA
	BA-140	4.07E+02	NO DATA
	CS-137	0.00E-01	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	5.86E+01	NO DATA
	LA-140	4.68E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
SC:COLUMBIA	I-131	NO DATA	1.33E+00
	BA-140	NO DATA	4.36E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	2.19E+01
	RU103,106,BE7	NO DATA	2.08E+01
	ZR,NB-95	NO DATA	4.09E+00
	BI-214	NO DATA	0.00E-01
SOUTH CAROLINA	I-131	5.65E+02	1.33E+00
	BA-140	4.07E+02	4.36E+00
	CS-137	0.00E-01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	5.86E+01	NO DATA
	LA-140	4.68E+02	NO DATA
	CE-141,144	NO DATA	2.19E+01
	RU103,106,BE7	NO DATA	2.08E+01
	ZR,NB-95	NO DATA	4.09E+00
	BI-214	NO DATA	0.00E-01
SD:PIERRE	I-131	NO DATA	9.03E-01
	BA-140	NO DATA	2.14E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	1.56E+01
	RU103,106,BE7	NO DATA	9.22E+00
	ZR,NB-95	NO DATA	2.47E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
SD:RAPID CITY	I-131	6.60E+02	NO DATA
	BA-140	7.21E+02	NO DATA
	CS-137	3.58E+01	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.77E+02	NO DATA
	LA-140	8.28E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
SOUTH DAKOTA	I-131	6.60E+02	9.03E-01
	BA-140	7.21E+02	2.14E+00
	CS-137	3.58E+01	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.77E+02	NO DATA
	LA-140	8.28E+02	NO DATA
	CE-141,144	NO DATA	1.56E+01
	RU103,106,BE7	NO DATA	9.22E+00
	ZR,NB-95	NO DATA	2.47E+00
	BI-214	NO DATA	0.00E-01
TN:CHATTANOOGA	I-131	3.76E+02	NO DATA
	BA-140	9.85E+00	NO DATA
	CS-137	2.53E+02	NO DATA
	K-40	2.49E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	3.59E+02	NO DATA
	LA-140	9.95E+00	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
TN:KNOXVILLE	I-131	8.61E+02	NO DATA
	BA-140	5.75E+02	NO DATA
	CS-137	2.64E+02	NO DATA
	K-40	1.41E+03	NO DATA
	SR-90	1.51E+02	NO DATA
	SR-89	9.70E+01	NO DATA
	LA-140	6.62E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA

TABLE A2 (Continued)

		Pathway	
Location	Nuclide	Milk (pCi-d/liter)	Air (pCi-d/m**3)
TN:MEMPHIS	I-131	1.00E+03	NO DATA
	BA-140	9.89E+02	NO DATA
	CS-137	1.64E+02	NO DATA
	K-40	1.29E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.14E+03	NO DATA
	LA-140	1.14E+03	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
TN:NASHVILLE	I-131	NO DATA	8.10E-01
	BA-140	NO DATA	2.04E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	1.10E+01
	RU103,106,BE7	NO DATA	7.43E+00
	ZR,NB-95	NO DATA	1.43E+00
	BI-214	NO DATA	0.00E-01
TENNESSEE	I-131	7.45E+02	8.10E-01
	BA-140	5.24E+02	2.04E+00
	CS-137	2.27E+02	0.00E-01
	K-40	1.73E+03	NO DATA
	SR-90	5.03E+01	NO DATA
	SR-89	5.32E+02	NO DATA
	LA-140	6.03E+02	NO DATA
	CE-141,144	NO DATA	1.10E+01
	RU103,106,BE7	NO DATA	7.43E+00
	ZR,NB-95	NO DATA	1.43E+00
	BI-214	NO DATA	0.00E-01
TX:AUSTIN	I-131	3.09E+01	9.00E-02
	BA-140	2.70E+02	1.23E+00
	CS-137	0.00E-01	0.00E-01
	K-40	1.85E+03	NO DATA
	SR-90	1.00E+00	NO DATA
	SR-89	1.00E+00	NO DATA
	LA-140	3.13E+02	NO DATA
	CE-141,144	NO DATA	5.54E+00
	RU103,106,BE7	NO DATA	7.52E+00
	ZR,NB-95	NO DATA	2.03E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
TX:DALLAS	I-131	4.82E+02	NO DATA
	BA-140	1.45E+02	NO DATA
	CS-137	1.66E+01	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	3.07E+00	NO DATA
	SR-89	3.07E+01	NO DATA
	LA-140	1.67E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
TX:EL PASO	I-131	NO DATA	4.18E-01
	BA-140	NO DATA	0.00E-01
	CS-137	NO DATA	2.91E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	0.00E-01
	RU103,106,BE7	NO DATA	0.00E-01
	ZR,NB-95	NO DATA	0.00E-01
	BI-214	NO DATA	0.00E-01
TEXAS	I-131	2.56E+02	2.54E-01
	BA-140	2.07E+02	6.15E-01
	CS-137	8.30E+00	1.45E-01
	K-40	9.25E+02	NO DATA
	SR-90	2.03E+00	NO DATA
	SR-89	1.58E+01	NO DATA
	LA-140	2.40E+02	NO DATA
	CE-141,144	NO DATA	2.77E+00
	RU103,106,BE7	NO DATA	3.76E+00
	ZR,NB-95	NO DATA	1.01E+00
	BI-214	NO DATA	0.00E-01
UT:SALT LAKE CITY	I-131	1.22E+03	4.22E+00
	BA-140	6.45E+02	1.19E+01
	CS-137	1.89E+02	0.00E-01
	K-40	1.40E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.47E+02	NO DATA
	LA-140	7.41E+02	NO DATA
	CE-141,144	NO DATA	2.56E+01
	RU103,106,BE7	NO DATA	3.14E+01
	ZR,NB-95	NO DATA	7.58E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway	
		Milk (pCi-d/liter)	Air (pCi-d/m**3)
UTAH	I-131	1.22E+03	4.22E+00
	BA-140	6.45E+02	1.19E+01
	CS-137	1.89E+02	0.00E-01
	K-40	1.40E+03	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.47E+02	NO DATA
	LA-140	7.41E+02	NO DATA
	CE-141,144	NO DATA	2.56E+01
	RU103,106,BE7	NO DATA	3.14E+01
	ZR,NB-95	NO DATA	7.58E+00
	BI-214	NO DATA	0.00E-01
VA:LYNCHBURG	I-131	NO DATA	7.89E-01
	BA-140	NO DATA	2.47E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	1.10E+01
	RU103,106,BE7	NO DATA	1.15E+01
	ZR,NB-95	NO DATA	2.22E+00
	BI-214	NO DATA	0.00E-01
VA:NORFOLK	I-131	1.79E+02	2.67E-01
	BA-140	1.83E+02	0.00E-01
	CS-137	0.00E-01	1.58E-01
	K-40	2.50E+03	NO DATA
	SR-90	2.27E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	2.11E+02	NO DATA
	CE-141,144	NO DATA	0.00E-01
	RU103,106,BE7	NO DATA	0.00E-01
	ZR,NB-95	NO DATA	3.85E-01
	BI-214	NO DATA	0.00E-01
VIRGINIA	I-131	1.79E+02	5.28E-01
	BA-140	1.83E+02	1.23E+00
	CS-137	0.00E-01	7.90E-02
	K-40	2.50E+03	NO DATA
	SR-90	2.27E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	2.11E+02	NO DATA
	CE-141,144	NO DATA	5.50E+00
	RU103,106,BE7	NO DATA	5.75E+00
	ZR,NB-95	NO DATA	1.30E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	Air (pCi-d/m**3)
VT:BURLINGTON	I-131	1.58E+02	3.44E-01
	BA-140	7.25E+02	9.12E-01
	CS-137	1.54E+02	2.55E-03
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.52E+02	NO DATA
	LA-140	8.34E+02	NO DATA
	CE-141,144	NO DATA	4.70E+00
	RU103,106,BE7	NO DATA	2.53E+00
	ZR,NB-95	NO DATA	1.43E+00
	BI-214	NO DATA	9.57E-02
VERMONT	I-131	1.58E+02	3.44E-01
	BA-140	7.25E+02	9.12E-01
	CS-137	1.54E+02	2.55E-03
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	2.52E+02	NO DATA
	LA-140	8.34E+02	NO DATA
	CE-141,144	NO DATA	4.70E+00
	RU103,106,BE7	NO DATA	2.53E+00
	ZR,NB-95	NO DATA	1.43E+00
	BI-214	NO DATA	9.57E-02
WA:SEATTLE	I-131	3.78E+02	1.21E-01
	BA-140	2.22E+02	7.94E-01
	CS-137	4.54E+01	1.38E-02
	K-40	1.64E+03	NO DATA
	SR-90	4.24E+01	NO DATA
	SR-89	0.00E-01	NO DATA
	LA-140	2.56E+02	NO DATA
	CE-141,144	NO DATA	3.21E+00
	RU103,106,BE7	NO DATA	3.23E+00
	ZR,NB-95	NO DATA	1.16E+00
	BI-214	NO DATA	9.25E-02
WA:SPOKANE	I-131	1.18E+02	2.76E-01
	BA-140	2.37E+02	6.11E-01
	CS-137	2.11E+02	4.85E-03
	K-40	1.95E+03	NO DATA
	SR-90	3.90E+00	NO DATA
	SR-89	4.00E+00	NO DATA
	LA-140	2.73E+02	NO DATA
	CE-141,144	NO DATA	3.90E+00
	RU103,106,BE7	NO DATA	3.58E+00
	ZR,NB-95	NO DATA	9.16E-01
	BI-214	NO DATA	8.15E-02

TABLE A2 (Continued)

		Pathway	
Location	Nuclide	Milk (pCi-d/liter)	Air (pCi-d/m**3)
WASHINGTON	I-131	2.48E+02	1.98E-01
	BA-140	2.29E+02	7.02E-01
	CS-137	1.28E+02	9.32E-03
	K-40	1.79E+03	NO DATA
	SR-90	2.31E+01	NO DATA
	SR-89	2.00E+00	NO DATA
	LA-140	2.64E+02	NO DATA
	CE-141,144	NO DATA	3.55E+00
	RU103,106,BE7	NO DATA	3.40E+00
	ZR,NB-95	NO DATA	1.03E+00
	BI-214	NO DATA	8.70E-02
WI:MADISON	I-131	NO DATA	4.61E-01
	BA-140	NO DATA	1.70E+00
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	6.60E+00
	RU103,106,BE7	NO DATA	7.73E+00
	ZR,NB-95	NO DATA	2.06E+00
	BI-214	NO DATA	0.00E-01
WI:MILWAUKEE	I-131	1.30E+03	NO DATA
	BA-140	4.86E+02	NO DATA
	CS-137	9.06E+01	NO DATA
	K-40	8.58E+02	NO DATA
	SR-90	3.45E+01	NO DATA
	SR-89	6.79E+02	NO DATA
	LA-140	5.59E+02	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA
WISCONSIN	I-131	1.30E+03	4.61E-01
	BA-140	4.86E+02	1.70E+00
	CS-137	9.06E+01	0.00E-01
	K-40	8.58E+02	NO DATA
	SR-90	3.45E+01	NO DATA
	SR-89	6.79E+02	NO DATA
	LA-140	5.59E+02	NO DATA
	CE-141,144	NO DATA	6.60E+00
	RU103,106,BE7	NO DATA	7.73E+00
	ZR,NB-95	NO DATA	2.06E+00
	BI-214	NO DATA	0.00E-01

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	 Air (pCi-d/m**3)
WV:CHARLESTON	I-131	7.66E+02	6.29E-01
	BA-140	1.14E+02	2.10E+00
	CS-137	1.50E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.71E+02	NO DATA
	LA-140	1.31E+02	NO DATA
	CE-141,144	NO DATA	1.17E+01
	RU103,106,BE7	NO DATA	1.27E+01
	ZR,NB-95	NO DATA	3.21E+00
	BI-214	NO DATA	0.00E-01
WEST VIRGINIA	I-131	7.66E+02	6.29E-01
	BA-140	1.14E+02	2.10E+00
	CS-137	1.50E+02	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	1.71E+02	NO DATA
	LA-140	1.31E+02	NO DATA
	CE-141,144	NO DATA	1.17E+01
	RU103,106,BE7	NO DATA	1.27E+01
	ZR,NB-95	NO DATA	3.21E+00
	BI-214	NO DATA	0.00E-01
WY:CHEYENNE	I-131	NO DATA	8.36E+00
	BA-140	NO DATA	1.72E+01
	CS-137	NO DATA	0.00E-01
	K-40	NO DATA	NO DATA
	SR-90	NO DATA	NO DATA
	SR-89	NO DATA	NO DATA
	LA-140	NO DATA	NO DATA
	CE-141,144	NO DATA	3.98E+01
	RU103,106,BE7	NO DATA	4.63E+01
	ZR,NB-95	NO DATA	8.90E+00
	BI-214	NO DATA	0.00E-01
WY:LARAMIE	I-131	0.00E-01	NO DATA
	BA-140	0.00E-01	NO DATA
	CS-137	2.57E+00	NO DATA
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	5.66E+01	NO DATA
	LA-140	0.00E-01	NO DATA
	CE-141,144	NO DATA	NO DATA
	RU103,106,BE7	NO DATA	NO DATA
	ZR,NB-95	NO DATA	NO DATA
	BI-214	NO DATA	NO DATA

TABLE A2 (Continued)

Location	Nuclide	Pathway Milk (pCi-d/liter)	 Air (pCi-d/m**3)
WYOMING	I-131	0.00E-01	8.36E+00
	BA-140	0.00E-01	1.72E+01
	CS-137	2.57E+00	0.00E-01
	K-40	0.00E-01	NO DATA
	SR-90	0.00E-01	NO DATA
	SR-89	5.66E+01	NO DATA
	LA-140	0.00E-01	NO DATA
	CE-141,144	NO DATA	3.98E+01
	RU103,106,BE7	NO DATA	4.63E+01
	ZR,NB-95	NO DATA	8.90E+00
	BI-214	NO DATA	0.00E-01

TABLE A3

Individual dose (mrem) as a function of state, age group, and organ

		Organ							
State	Age	Bone	Liver	T. Body	Thyroid	Kidney	Lung	Gi_Lli	Skin
ALASKA	INFANT	3.69E+00	9.22E-01	7.43E-01	2.05E+01	8.31E-01	8.74E-01	1.25E-01	7.43E-01
	CHILD	1.82E+00	4.53E-01	3.86E-01	4.55E+00	4.26E-01	6.47E-01	8.00E-02	3.86E-01
	TEEN	7.03E-01	1.87E-01	1.52E-01	1.64E+00	1.74E-01	4.07E-01	7.55E-02	1.52E-01
	ADULT	4.49E-01	1.20E-01	9.86E-02	8.33E-01	1.11E-01	2.65E-01	5.68E-02	9.88E-02
ALABAMA	INFANT	1.31E+00	7.92E-02	5.15E-02	5.42E+00	7.26E-02	5.64E-01	1.19E-01	5.23E-02
	CHILD	6.07E-01	8.58E-02	2.77E-02	1.18E+00	6.62E-02	1.08E+00	9.82E-02	2.85E-02
	TEEN	2.46E-01	6.31E-02	1.27E-02	4.39E-01	4.87E-02	1.04E+00	1.18E-01	1.35E-02
	ADULT	1.64E-01	4.90E-02	8.93E-03	2.28E-01	3.69E-02	6.91E-01	1.05E-01	9.69E-03
ARKANSAS	INFANT	2.93E+00	2.37E-01	1.09E-01	8.56E+00	1.57E-01	5.50E-01	1.85E-01	1.10E-01
	CHILD	1.11E+00	1.35E-01	4.77E-02	1.87E+00	9.37E-02	9.50E-01	1.33E-01	4.84E-02
	TEEN	3.86E-01	8.21E-02	2.12E-02	6.90E-01	5.79E-02	9.04E-01	1.41E-01	2.19E-02
	ADULT	2.36E-01	5.95E-02	1.51E-02	3.58E-01	4.14E-02	5.97E-01	1.17E-01	1.58E-02
ARIZONA	INFANT	3.22E-01	7.54E-02	2.22E-02	3.47E+00	5.11E-02	1.16E+00	8.94E-02	2.39E-02
	CHILD	6.14E-01	1.79E-01	3.62E-02	9.00E-01	1.20E-01	2.37E+00	1.17E-01	3.79E-02
	TEEN	3.68E-01	1.46E-01	2.19E-02	3.96E-01	1.05E-01	2.30E+00	1.79E-01	2.37E-02
	ADULT	2.88E-01	1.16E-01	1.72E-02	2.53E-01	8.23E-02	1.53E+00	1.78E-01	1.89E-02
CALIFORNIA	INFANT	5.25E-01	1.94E-01	7.87E-02	1.35E+00	1.09E-01	6.09E-01	8.52E-02	7.95E-02
	CHILD	4.44E-01	1.40E-01	5.27E-02	3.42E-01	9.46E-02	1.13E+00	7.96E-02	5.34E-02
	TEEN	2.25E-01	8.79E-02	2.61E-02	1.40E-01	6.25E-02	1.08E+00	1.04E-01	2.69E-02
	ADULT	1.65E-01	6.48E-02	1.93E-02	8.32E-02	4.64E-02	7.17E-01	9.59E-02	2.01E-02
COLORADO	INFANT	1.66E+00	6.50E-01	3.08E-01	6.98E+00	4.24E-01	2.98E+00	1.03E-01	3.12E-01
	CHILD	2.08E+00	6.58E-01	2.31E-01	2.04E+00	4.54E-01	5.67E+00	2.13E-01	2.35E-01
	TEEN	1.15E+00	4.54E-01	1.15E-01	9.51E-01	3.22E-01	5.44E+00	3.70E-01	1.19E-01
	ADULT	8.74E-01	3.47E-01	8.44E-02	6.46E-01	2.44E-01	3.60E+00	3.84E-01	8.85E-02
CONNECTICUT	INFANT	9.37E-01	1.03E-01	3.78E-02	3.27E+00	5.76E-02	1.38E-01	9.44E-02	3.80E-02
	CHILD	3.12E-01	3.75E-02	1.46E-02	7.08E-01	2.50E-02	2.21E-01	6.07E-02	1.47E-02
	TEEN	9.47E-02	1.74E-02	6.63E-03	2.60E-01	1.25E-02	2.08E-01	5.71E-02	6.78E-03
	ADULT	5.21E-02	1.09E-02	4.89E-03	1.34E-01	8.08E-03	1.38E-01	4.32E-02	5.03E-03
D.C.	INFANT	1.02E+00	3.34E-01	2.33E-01	6.00E+00	2.70E-01	4.71E-01	6.77E-02	2.34E-01
	CHILD	6.21E-01	1.83E-01	1.28E-01	1.40E+00	1.56E-01	6.10E-01	5.31E-02	1.28E-01
	TEEN	2.70E-01	8.86E-02	5.28E-02	5.38E-01	7.34E-02	5.24E-01	6.11E-02	5.32E-02
	ADULT	1.84E-01	6.03E-02	3.54E-02	2.97E-01	4.94E-02	3.45E-01	5.30E-02	3.58E-02
DELAWARE	INFANT	7.38E-01	3.47E-01	4.87E-02	5.59E+00	1.23E-01	2.30E-01	1.20E-01	4.89E-02
	CHILD	2.95E-01	1.19E-01	2.52E-02	1.21E+00	5.56E-02	3.78E-01	8.00E-02	2.54E-02
	TEEN	1.03E-01	5.42E-02	1.72E-02	4.53E-01	2.89E-02	3.59E-01	7.83E-02	1.75E-02
	ADULT	6.32E-02	3.24E-02	1.51E-02	2.38E-01	1.83E-02	2.37E-01	6.10E-02	1.54E-02
FLORIDA	INFANT	1.21E+00	3.20E-01	2.63E-01	4.74E+00	2.95E-01	1.24E+00	8.36E-02	2.65E-01
	CHILD	1.10E+00	3.07E-01	1.64E-01	1.19E+00	2.45E-01	2.15E+00	1.04E-01	1.65E-01
	TEEN	5.61E-01	1.95E-01	7.08E-02	4.77E-01	1.50E-01	2.02E+00	1.57E-01	7.23E-02
	ADULT	4.12E-01	1.47E-01	4.82E-02	2.79E-01	1.11E-01	1.34E+00	1.55E-01	4.97E-02

TABLE A3 (Continued)

		Organ							
State	Age	Bone	Liver	T. Body	Thyroid	Kidney	Lung	Gi_Lli	Skin
GEORGIA	INFANT	8.79E-01	1.55E-01	9.93E-02	2.46E+00	1.28E-01	1.46E+00	1.09E-01	1.01E-01
	CHILD	9.07E-01	2.37E-01	7.90E-02	7.89E-01	1.73E-01	2.85E+00	1.41E-01	8.10E-02
	TEEN	4.89E-01	1.77E-01	3.92E-02	3.94E-01	1.32E-01	2.75E+00	2.15E-01	4.12E-02
	ADULT	3.69E-01	1.39E-01	2.85E-02	2.83E-01	1.02E-01	1.82E+00	2.13E-01	3.05E-02
HAWAII	INFANT	4.37E-01	7.33E-02	2.07E-02	2.46E+00	4.13E-02	5.64E-01	4.10E-02	2.15E-02
	CHILD	1.67E-01	2.95E-02	1.04E-02	6.39E-01	3.01E-02	1.11E+00	5.38E-02	1.11E-02
	TEEN	5.84E-02	1.50E-02	5.77E-03	2.85E-01	2.08E-02	1.08E+00	8.26E-02	6.53E-03
	ADULT	3.58E-02	9.95E-03	4.62E-03	1.85E-01	1.54E-02	7.17E-01	8.21E-02	5.37E-03
IOWA	INFANT	2.06E+00	2.52E-01	9.25E-02	1.45E+01	1.64E-01	3.34E-01	8.56E-02	9.28E-02
	CHILD	7.33E-01	1.02E-01	3.68E-02	3.09E+00	7.47E-02	5.23E-01	6.32E-02	3.72E-02
	TEEN	2.38E-01	5.27E-02	1.67E-02	1.12E+00	3.92E-02	4.91E-01	6.94E-02	1.70E-02
	ADULT	1.38E-01	3.51E-02	1.20E-02	5.62E-01	2.57E-02	3.24E-01	5.83E-02	1.24E-02
IDAHO	INFANT	5.18E-01	2.34E-01	4.07E-02	7.29E+00	1.08E-01	1.00E+00	8.57E-02	4.22E-02
	CHILD	6.25E-01	2.08E-01	4.19E-02	1.72E+00	1.28E-01	1.99E+00	1.05E-01	4.34E-02
	TEEN	3.49E-01	1.49E-01	2.65E-02	6.95E-01	1.01E-01	1.94E+00	1.56E-01	2.80E-02
	ADULT	2.67E-01	1.13E-01	2.16E-02	4.05E-01	7.70E-02	1.28E+00	1.53E-01	2.30E-02
ILLINOIS	INFANT	4.44E+00	9.60E-01	8.11E-01	1.32E+01	8.71E-01	9.52E-01	1.76E-01	8.11E-01
	CHILD	2.08E+00	4.74E-01	4.20E-01	3.03E+00	4.48E-01	7.07E-01	1.10E-01	4.20E-01
	TEEN	7.81E-01	1.91E-01	1.64E-01	1.10E+00	1.79E-01	4.44E-01	1.01E-01	1.64E-01
	ADULT	4.90E-01	1.22E-01	1.06E-01	5.63E-01	1.14E-01	2.89E-01	7.41E-02	1.06E-01
INDIANA	INFANT	2.22E+00	4.00E-01	3.27E-01	1.10E+01	3.72E-01	7.76E-01	1.17E-01	3.28E-01
	CHILD	1.13E+00	2.43E-01	1.74E-01	2.44E+00	2.18E-01	1.09E+00	9.34E-02	1.74E-01
	TEEN	4.58E-01	1.24E-01	6.98E-02	8.90E-01	1.07E-01	9.71E-01	1.09E-01	7.05E-02
	ADULT	3.03E-01	8.73E-02	4.57E-02	4.57E-01	7.33E-02	6.41E-01	9.57E-02	4.64E-02
KANSAS	INFANT	1.06E+00	2.16E-01	4.92E-02	4.96E+00	9.84E-02	3.86E-01	7.94E-02	4.97E-02
	CHILD	5.01E-01	1.16E-01	2.82E-02	1.11E+00	6.68E-02	7.08E-01	6.53E-02	2.87E-02
	TEEN	2.04E-01	6.98E-02	1.62E-02	4.27E-01	4.43E-02	6.80E-01	7.81E-02	1.67E-02
	ADULT	1.36E-01	4.97E-02	1.30E-02	2.34E-01	3.20E-02	4.49E-01	6.92E-02	1.35E-02
KENTUCKY	INFANT	2.33E+00	5.07E-01	2.99E-01	9.73E+00	3.65E-01	5.11E-01	1.33E-01	2.99E-01
	CHILD	1.02E+00	2.30E-01	1.52E-01	2.15E+00	1.86E-01	5.77E-01	8.94E-02	1.53E-01
	TEEN	3.73E-01	1.01E-01	6.33E-02	7.84E-01	8.17E-02	4.77E-01	8.87E-02	6.37E-02
	ADULT	2.32E-01	6.53E-02	4.29E-02	4.01E-01	5.29E-02	3.14E-01	6.96E-02	4.32E-02
LOUISIANA	INFANT	8.68E-02	3.43E-02	1.22E-02	4.27E+00	3.06E-02	3.97E-01	3.14E-02	1.27E-02
	CHILD	1.69E-01	5.21E-02	1.20E-02	9.16E-01	4.00E-02	7.99E-01	4.01E-02	1.25E-02
	TEEN	1.01E-01	4.13E-02	6.83E-03	3.34E-01	3.24E-02	7.77E-01	6.07E-02	7.40E-03
	ADULT	7.94E-02	3.25E-02	5.20E-03	1.69E-01	2.49E-02	5.15E-01	6.00E-02	5.77E-03
MASSACHUSETTS	INFANT	8.70E-01	1.79E-01	4.39E-02	6.51E+00	9.00E-02	2.60E-01	5.46E-02	4.42E-02
	CHILD	3.72E-01	8.25E-02	2.19E-02	1.39E+00	5.03E-02	4.55E-01	4.39E-02	2.22E-02
	TEEN	1.40E-01	4.63E-02	1.20E-02	5.06E-01	3.04E-02	4.35E-01	5.16E-02	1.23E-02
	ADULT	9.03E-02	3.19E-02	9.52E-03	2.56E-01	2.11E-02	2.87E-01	4.52E-02	9.84E-03

TABLE A3 (Continued)

		Organ							
State	Age	Bone	Liver	T. Body	Thyroid	Kidney	Lung	Gi_Lli	Skin
MARYLAND	INFANT	5.73E-01	1.34E-01	3.04E-02	4.91E+00	6.73E-02	2.71E-01	2.05E-02	3.08E-02
	CHILD	2.98E-01	7.49E-02	1.79E-02	1.11E+00	4.60E-02	5.01E-01	2.56E-02	1.83E-02
	TEEN	1.27E-01	4.63E-02	1.03E-02	4.28E-01	3.06E-02	4.81E-01	3.87E-02	1.06E-02
	ADULT	8.72E-02	3.33E-02	8.22E-03	2.37E-01	2.21E-02	3.18E-01	3.81E-02	8.59E-03
MAINE	INFANT	7.18E-01	4.38E-02	3.44E-02	4.82E+00	4.22E-02	1.55E-01	1.91E-01	3.46E-02
	CHILD	2.98E-01	3.74E-02	1.53E-02	1.03E+00	2.93E-02	2.80E-01	1.19E-01	1.55E-02
	TEEN	1.13E-01	2.65E-02	6.40E-03	3.77E-01	1.97E-02	2.68E-01	1.07E-01	6.61E-03
	ADULT	7.33E-02	2.03E-02	4.23E-03	1.91E-01	1.44E-02	1.78E-01	7.81E-02	4.44E-03
MICHIGAN	INFANT	3.74E+00	7.04E-01	5.98E-01	1.12E+01	6.49E-01	1.02E+00	1.45E-01	5.99E-01
	CHILD	1.80E+00	3.87E-01	3.13E-01	2.57E+00	3.57E-01	1.18E+00	1.08E-01	3.14E-01
	TEEN	6.99E-01	1.76E-01	1.24E-01	9.42E-01	1.58E-01	9.75E-01	1.20E-01	1.24E-01
	ADULT	4.49E-01	1.19E-01	8.02E-02	4.93E-01	1.05E-01	6.42E-01	1.02E-01	8.09E-02
MINNESOTA	INFANT	4.73E+00	1.20E+00	9.95E-01	1.77E+01	1.08E+00	1.14E+00	1.45E-01	9.95E-01
	CHILD	2.34E+00	5.87E-01	5.20E-01	4.04E+00	5.55E-01	8.01E-01	9.20E-02	5.20E-01
	TEEN	9.00E-01	2.35E-01	2.04E-01	1.47E+00	2.21E-01	4.79E-01	8.59E-02	2.04E-01
	ADULT	5.72E-01	1.49E-01	1.32E-01	7.53E-01	1.40E-01	3.11E-01	6.42E-02	1.32E-01
MISSOURI	INFANT	1.67E+00	2.74E-01	2.42E-01	6.28E+00	2.64E-01	5.56E-01	9.99E-02	2.42E-01
	CHILD	8.07E-01	1.62E-01	1.26E-01	1.41E+00	1.52E-01	7.73E-01	7.60E-02	1.27E-01
	TEEN	3.17E-01	7.91E-02	5.01E-02	5.17E-01	7.18E-02	6.83E-01	8.54E-02	5.05E-02
	ADULT	2.05E-01	5.49E-02	3.24E-02	2.68E-01	4.87E-02	4.52E-01	7.29E-02	3.29E-02
MISSISSIPPI	INFANT	2.49E+00	1.13E-01	8.96E-02	8.15E+00	1.13E-01	3.67E-01	1.65E-01	9.01E-02
	CHILD	8.70E-01	6.67E-02	3.39E-02	1.75E+00	5.93E-02	6.09E-01	1.12E-01	3.44E-02
	TEEN	2.80E-01	4.05E-02	1.24E-02	6.38E-01	3.40E-02	5.76E-01	1.12E-01	1.28E-02
	ADULT	1.62E-01	2.98E-02	7.62E-03	3.23E-01	2.39E-02	3.81E-01	8.90E-02	8.04E-03
MONTANA	INFANT	6.74E-01	2.10E-01	4.58E-02	9.48E+00	1.06E-01	4.29E-01	8.03E-02	4.64E-02
	CHILD	3.70E-01	1.08E-01	2.63E-02	2.04E+00	6.86E-02	8.01E-01	6.83E-02	2.69E-02
	TEEN	1.63E-01	6.53E-02	1.53E-02	7.47E-01	4.49E-02	7.72E-01	8.35E-02	1.59E-02
	ADULT	1.13E-01	4.62E-02	1.23E-02	3.81E-01	3.20E-02	5.11E-01	7.49E-02	1.29E-02
NORTH CAROLINA	INFANT	1.35E-01	4.18E-02	1.41E-02	4.67E+00	3.20E-02	1.53E-01	3.60E-02	1.43E-02
	CHILD	8.62E-02	2.49E-02	7.35E-03	9.92E-01	2.06E-02	2.92E-01	2.88E-02	7.55E-03
	TEEN	4.12E-02	1.62E-02	3.78E-03	3.58E-01	1.36E-02	2.82E-01	3.36E-02	3.98E-03
	ADULT	2.97E-02	1.19E-02	2.79E-03	1.79E-01	9.73E-03	1.87E-01	2.95E-02	2.99E-03
NORTH DAKOTA	INFANT	9.38E-01	3.46E-01	2.02E-01	3.01E+00	2.41E-01	5.31E-01	6.41E-02	2.02E-01
	CHILD	5.99E-01	1.89E-01	1.14E-01	7.18E-01	1.46E-01	7.77E-01	5.58E-02	1.14E-01
	TEEN	2.67E-01	9.44E-02	4.92E-02	2.71E-01	7.31E-02	6.97E-01	6.94E-02	4.97E-02
	ADULT	1.84E-01	6.47E-02	3.40E-02	1.[illegible]3E-01	5.02E-02	4.61E-01	6.28E-02	3.45E-02
NEBRASKA	INFANT	6.72E-01	1.06E-01	3.13E-02	3.12E+00	5.50E-02	3.78E-01	1.00E-01	3.18E-02
	CHILD	3.72E-01	8.11E-02	2.03E-02	6.79E-01	5.11E-02	7.30E-01	7.81E-02	2.08E-02
	TEEN	1.66E-01	5.56E-02	1.12E-02	2.51E-01	3.78E-02	7.06E-01	8.94E-02	1.17E-02
	ADULT	1.16E-01	4.18E-02	8.70E-03	1.30E-01	2.84E-02	4.67E-01	7.73E-02	9.23E-03

TABLE A3 (Continued)

		Organ							
State	Age	Bone	Liver	T. Body	Thyroid	Kidney	Lung	Gi_Lli	Skin
NEW HAMPSHIRE	INFANT	2.42E+00	6.97E-01	5.84E-01	6.20E+00	6.21E-01	7.15E-01	8.64E-02	5.84E-01
	CHILD	1.33E+00	3.62E-01	3.12E-01	1.51E+00	3.34E-01	5.78E-01	5.78E-02	3.12E-01
	TEEN	5.39E-01	1.52E-01	1.24E-01	5.57E-01	1.38E-01	3.84E-01	5.71E-02	1.24E-01
	ADULT	3.53E-01	9.90E-02	8.04E-02	2.98E-01	8.92E-02	2.51E-01	4.48E-02	8.07E-02
NEW JERSEY	INFANT	7.64E-01	1.52E-01	4.05E-02	6.98E+00	8.18E-02	2.10E-01	5.89E-02	4.07E-02
	CHILD	3.01E-01	6.30E-02	1.83E-02	1.49E+00	4.09E-02	3.59E-01	4.38E-02	1.85E-02
	TEEN	1.07E-01	3.34E-02	9.60E-03	5.39E-01	2.31E-02	3.42E-01	4.82E-02	9.85E-03
	ADULT	6.63E-02	2.23E-02	7.47E-03	2.71E-01	1.55E-02	2.26E-01	4.06E-02	7.72E-03
NEW MEXICO	INFANT	7.24E-01	2.17E-01	1.28E-01	3.21E+00	1.78E-01	2.66E+00	7.28E-02	1.32E-01
	CHILD	1.20E+00	3.56E-01	1.14E-01	7.61E-01	2.69E-01	5.27E+00	1.84E-01	1.17E-01
	TEEN	7.01E-01	2.69E-01	5.83E-02	2.89E-01	2.10E-01	5.11E+00	3.33E-01	6.20E-02
	ADULT	5.42E-01	2.11E-01	4.30E-02	1.56E-01	1.63E-01	3.38E+00	3.50E-01	4.66E-02
NEVADA	INFANT	3.13E-01	1.20E-01	2.19E-02	1.43E+00	6.74E-02	2.13E+00	4.15E-02	2.51E-02
	CHILD	1.01E+00	3.13E-01	5.96E-02	7.48E-01	2.07E-01	4.36E+00	1.45E-01	6.28E-02
	TEEN	6.31E-01	2.57E-01	3.81E-02	4.72E-01	1.84E-01	4.25E+00	2.73E-01	4.13E-02
	ADULT	4.99E-01	2.05E-01	3.05E-02	3.91E-01	1.46E-01	2.82E+00	2.90E-01	3.36E-02
NEW YORK	INFANT	1.86E+00	3.98E-01	2.35E-01	8.88E+00	2.91E-01	4.25E-01	9.09E-02	2.35E-01
	CHILD	8.04E-01	1.80E-01	1.19E-01	1.95E+00	1.47E-01	5.00E-01	6.34E-02	1.19E-01
	TEEN	2.93E-01	7.95E-02	4.95E-02	7.09E-01	6.51E-02	4.20E-01	6.58E-02	4.97E-02
	ADULT	1.82E-01	5.11E-02	3.35E-02	3.62E-01	4.21E-02	2.77E-01	5.33E-02	3.37E-02
OHIO	INFANT	1.44E+00	3.10E-01	1.78E-01	8.63E+00	2.30E-01	5.38E-01	7.65E-02	1.79E-01
	CHILD	7.31E-01	1.72E-01	9.56E-02	1.90E+00	1.36E-01	8.24E-01	6.48E-02	9.61E-02
	TEEN	2.99E-01	9.15E-02	4.11E-02	7.01E-01	7.13E-02	7.53E-01	7.92E-02	4.16E-02
	ADULT	1.99E-01	6.40E-02	2.82E-02	3.63E-01	4.92E-02	4.98E-01	7.10E-02	2.88E-02
OKLAHOMA	INFANT	1.98E+00	5.88E-01	4.81E-01	1.54E+00	5.09E-01	7.37E-01	3.78E-02	4.92E-01
	CHILD	1.13E+00	3.15E-01	2.61E-01	5.02E-01	2.84E-01	7.74E-01	3.61E-02	2.61E-01
	TEEN	4.68E-01	1.36E-01	1.05E-01	2.00E-01	1.21E-01	6.05E-01	4.79E-02	1.05E-01
	ADULT	3.10E-01	8.99E-02	6.86E-02	1.23E-01	7.99E-02	3.98E-01	4.47E-02	6.90E-02
OREGON	INFANT	1.65E+00	2.94E-01	2.80E-01	4.64E+00	2.91E-01	4.51E-01	1.24E-01	2.80E-01
	CHILD	7.89E-01	1.64E-01	1.45E-01	1.07E+00	1.60E-01	5.04E-01	8.18E-02	1.46E-01
	TEEN	3.04E-01	7.25E-02	5.65E-02	3.88E-01	6.88E-02	4.09E-01	7.98E-02	5.68E-02
	ADULT	1.95E-01	4.87E-02	3.62E-02	2.01E-01	4.54E-02	2.70E-01	6.20E-02	3.64E-02
PENNSYLVANIA	INFANT	7.50E-01	2.32E-01	4.32E-02	7.04E+00	1.03E-01	2.32E-01	2.58E-02	4.35E-02
	CHILD	3.04E-01	8.73E-02	2.12E-02	1.50E+00	4.86E-02	3.89E-01	2.62E-02	2.15E-02
	TEEN	1.09E-01	4.30E-02	1.29E-02	5.47E-01	2.63E-02	3.72E-01	3.60E-02	1.32E-02
	ADULT	6.78E-02	2.74E-02	1.08E-02	2.77E-01	1.73E-02	2.48E-01	3.42E-02	1.11E-02
RHODE ISLAND	INFANT	1.50E+00	1.35E-01	5.98E-02	6.22E+00	9.01E-02	2.48E-01	1.13E-01	6.01E-02
	CHILD	5.45E-01	6.50E-02	2.45E-02	1.34E+00	4.66E-02	4.11E-01	7.64E-02	2.48E-02
	TEEN	1.81E-01	3.66E-02	1.07E-02	4.86E-01	2.66E-02	3.89E-01	7.66E-02	1.10E-02
	ADULT	1.07E-01	2.56E-02	7.59E-03	2.47E-01	1.83E-02	2.57E-01	6.06E-02	7.88E-03

TABLE A3 (Continued)

State	Age	Organ							
		Bone	Liver	T. Body	Thyroid	Kidney	Lung	Gi_Lli	Skin
SOUTH CAROLINA	INFANT	3.56E-01	7.28E-02	2.56E-02	5.67E+00	5.58E-02	8.05E-01	7.84E-02	2.68E-02
	CHILD	4.98E-01	1.39E-01	2.98E-02	1.27E+00	9.49E-02	1.63E+00	9.02E-02	3.10E-02
	TEEN	2.87E-01	1.12E-01	1.73E-02	4.86E-01	7.95E-02	1.58E+00	1.31E-01	1.85E-02
	ADULT	2.22E-01	8.89E-02	1.33E-02	2.63E-01	6.20E-02	1.04E+00	1.27E-01	1.45E-02
SOUTH DAKOTA	INFANT	9.45E-01	1.01E-01	4.51E-02	6.62E+00	7.42E-02	4.83E-01	1.33E-01	4.58E-02
	CHILD	5.63E-01	1.13E-01	2.96E-02	1.45E+00	7.60E-02	9.32E-01	1.03E-01	3.03E-02
	TEEN	2.60E-01	8.45E-02	1.52E-02	5.39E-01	5.78E-02	9.00E-01	1.17E-01	1.59E-02
	ADULT	1.85E-01	6.55E-02	1.12E-02	2.82E-01	4.39E-02	5.95E-01	1.01E-01	1.19E-02
TENNESSEE	INFANT	2.56E+00	4.68E-01	3.07E-01	7.73E+00	3.61E-01	6.39E-01	1.27E-01	3.08E-01
	CHILD	1.19E+00	2.52E-01	1.61E-01	1.75E+00	2.04E-01	8.34E-01	9.26E-02	1.62E-01
	TEEN	4.61E-01	1.25E-01	6.67E-02	6.51E-01	9.84E-02	7.24E-01	1.00E-01	6.73E-02
	ADULT	2.97E-01	8.59E-02	4.49E-02	3.44E-01	6.66E-02	4.77E-01	8.38E-02	4.54E-02
TEXAS	INFANT	1.42E-01	3.25E-02	1.87E-02	2.57E+00	2.80E-02	1.40E-01	3.57E-02	1.89E-02
	CHILD	1.02E-01	2.67E-02	1.09E-02	5.58E-01	2.16E-02	2.61E-01	2.77E-02	1.11E-02
	TEEN	4.98E-02	1.79E-02	5.13E-03	2.05E-01	1.43E-02	2.50E-01	3.16E-02	5.31E-03
	ADULT	3.62E-02	1.35E-02	3.68E-03	1.06E-01	1.04E-02	1.66E-01	2.72E-02	3.87E-03
UTAH	INFANT	7.64E-01	2.30E-01	5.61E-02	1.23E+01	1.31E-01	1.14E+00	1.26E-01	5.78E-02
	CHILD	6.99E-01	2.06E-01	4.64E-02	2.79E+00	1.38E-01	2.24E+00	1.35E-01	4.80E-02
	TEEN	3.70E-01	1.48E-01	2.74E-02	1.09E+00	1.06E-01	2.18E+00	1.90E-01	2.90E-02
	ADULT	2.78E-01	1.13E-01	2.16E-02	6.05E-01	8.05E-02	1.45E+00	1.82E-01	2.33E-02
VIRGINIA	INFANT	4.88E-01	1.26E-01	1.14E-01	1.90E+00	1.22E-01	3.20E-01	3.69E-02	1.14E-01
	CHILD	3.43E-01	9.21E-02	6.45E-02	4.62E-01	8.13E-02	4.88E-01	3.33E-02	6.48E-02
	TEEN	1.59E-01	5.03E-02	2.64E-02	1.79E-01	4.24E-02	4.42E-01	4.24E-02	2.67E-02
	ADULT	1.12E-01	3.65E-02	1.74E-02	1.00E-01	2.99E-02	2.92E-01	3.88E-02	1.78E-02
VERMONT	INFANT	8.68E-01	1.29E-01	3.57E-02	1.61E+00	5.60E-02	1.64E-01	1.27F-01	3.59E-02
	CHILD	3.50E-01	6.35E-02	1.77E-02	3.63E-01	3.44E-02	2.83E-01	8.18E-02	1.79E-02
	TEEN	1.28E-01	3.64E-02	9.48E-03	1.40E-01	2.16E-02	2.69E-01	7.68E-02	9.69E-03
	ADULT	8.03E-02	2.54E-02	7.49E-03	7.64E-02	1.54E-02	1.78E-01	5.78E-02	7.70E-03
WASHINGTON	INFANT	5.68E-01	2.05E-01	1.23E-01	2.59E+00	1.46E-01	2.52E-01	4.35E-02	1.23E-01
	CHILD	3.37E-01	1.05E-01	6.74E-02	5.94E-01	8.34E-02	3.29E-01	3.26E-02	6.76E-02
	TEEN	1.45E-01	5.01E-02	2.87E-02	2.21E-01	3.93E-02	2.84E-01	3.61E-02	2.89E-02
	ADULT	9.83E-02	3.36E-02	1.97E-02	1.17E-01	2.64E-02	1.87E-01	3.06E-02	1.99E-02
WISCONSIN	INFANT	2.56E+00	3.35E-01	2.46E-01	1.32E+01	2.98E-01	5.12E-01	1.24E-01	2.46E-01
	CHILD	1.04E+00	1.71E-01	1.20E-01	2.86E+00	1.54E-01	6.65E-01	8.73E-02	1.20E-01
	TEEN	3.71E-01	8.18E-02	4.74E-02	1.03E+00	7.16E-02	5.81E-01	9.12E-02	4.78E-02
	ADULT	2.28E-01	5.55E-02	3.08E-02	5.21E-01	4.74E-02	3.83E-01	7.43E-02	3.12E-02
WEST VIRGINIA	INFANT	6.19E-01	1.60E-01	3.80E-02	7.66E+00	8.77E-02	4.93E-01	3.46E-02	3.87E-02
	CHILD	4.03E-01	1.09E-01	2.56E-02	1.65E+00	7.13E-02	9.46E-01	4.57E-02	2.62E-02
	TEEN	1.91E-01	7.32E-02	1.47E-02	6.08E-01	5.09E-02	9.14E-01	7.02E-02	1.54E-02
	ADULT	1.38E-01	5.44E-02	1.16E-02	3.12E-01	3.77E-02	6.05E-01	6.98E-02	1.23E-02

TABLE A3 (Continued)

		Organ							
State	Age	Bone	Liver	T. Body	Thyroid	Kidney	Lung	Gi_Lli	Skin
WYOMING	INFANT	3.63E-01	8.75E-02	1.80E-02	2.22E-01	4.97E-02	1.64E+00	2.73E-02	2.05E-02
	CHILD	8.29E-01	2.44E-01	4.65E-02	4.28E-01	1.61E-01	3.34E+00	1.08E-01	4.90E-02
	TEEN	5.04E-01	2.01E-01	2.94E-02	3.27E-01	1.43E-01	3.26E+00	2.07E-01	3.19E-02
	ADULT	3.96E-01	1.61E-01	2.35E-02	2.97E-01	1.14E-01	2.16E+00	2.21E-01	2.59E-02

TABLE A4

Calculation of total U.S. milk production

Month (1977)	Milk produced in U.S. during month (Mlbs)	Fraction of month included in integration period	Milk produced in U.S. during integration period (Mlbs)
September	9907	13.5/30	4458.2
October	9902	31/31	9902
November	9497	30/30	9497
December	9497*	0.5/30	158.3
	Total U.S. milk production		24015.5 Mlbs

We assumed that all of this milk was or would be consumed in the U.S. The 1976 population data (IPA77) shown in Table A5 were used to determine the fraction of the U.S. population in each state. These fractions were multiplied by the total milk production of 24015.5 Mlbs. to obtain the estimated milk consumption for each state. These data are shown in Table A5.

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*December data was not available at the time of preparation of this report, so November data were used.

TABLE A5

Estimated population and milk consumption for each state

State	1976 state population	Fraction of 1976 U.S. population	Estimated milk consumption (Mlbs.)
ALASKA	382000.	0.0018	4.274E+01
ALABAMA	3665000.	0.0171	4.100E+02
ARKANSAS	2109000.	0.0098	2.360E+02
ARIZONA	2270000.	0.0106	2.540E+02
CALIFORNIA	21520000.	0.1003	2.408E+03
COLORADO	2583000.	0.0120	2.890E+02
CONNECTICUT	3117000.	0.0145	3.487E+02
D.C.	702000.	0.0033	7.854E+01
DELAWARE	582000.	0.0027	6.511E+01
FLORIDA	8421000.	0.0392	9.421E+02
GEORGIA	4970000.	0.0232	5.560E+02
HAWAII	887000.	0.0041	9.924E+01
IOWA	2870000.	0.0134	3.211E+02
IDAHO	831000.	0.0039	9.297E+01
ILLINOIS	11229000.	0.0523	1.256E+03
INDIANA	5302000.	0.0247	5.932E+02
KANSAS	2310000.	0.0108	2.584E+02
KENTUCKY	3428000.	0.0160	3.835E+02
LOUISIANA	3841000.	0.0179	4.297E+02
MASSACHUSETTS	5809000.	0.0271	6.499E+02
MARYLAND	4144000.	0.0193	4.636E+02
MAINE	1070000.	0.0050	1.197E+02
MICHIGAN	9104000.	0.0424	1.019E+03
MINNESOTA	3965000.	0.0185	4.436E+02
MISSOURI	4778000.	0.0223	5.346E+02
MISSISSIPPI	2354000.	0.0110	2.634E+02
MONTANA	753000.	0.0035	8.424E+01
NORTH CAROLINA	5469000.	0.0255	6.119E+02
NORTH DAKOTA	643000.	0.0030	7.194E+01
NEBRASKA	1553000.	0.0072	1.737E+02
NEW HAMPSHIRE	822000.	0.0038	9.196E+01
NEW JERSEY	7336000.	0.0342	8.207E+02
NEW MEXICO	1168000.	0.0054	1.307E+02
NEVADA	610000.	0.0028	6.825E+01
NEW YORK	18084000.	0.0842	2.023E+03
OHIO	10690000.	0.0498	1.196E+03
OKLAHOMA	2766000.	0.0129	3.095E+02
OREGON	2329000.	0.0108	2.606E+02
PENNSYLVANIA	11862000.	0.0553	1.327E+03
RHODE ISLAND	927000.	0.0043	1.037E+02
SOUTH CAROLINA	2848000.	0.0133	3.186E+02
SOUTH DAKOTA	686000.	0.0032	7.675E+01
TENNESSEE	4214000.	0.0196	4.715E+02
TEXAS	12487000.	0.0582	1.397E+03
UTAH	1228000.	0.0057	1.374E+02
VIRGINIA	5032000.	0.0234	5.630E+02
VERMONT	476000.	0.0022	5.325E+01
WASHINGTON	3612000.	0.0168	4.041E+02
WISCONSIN	4609000.	0.0215	5.156E+02
WEST VIRGINIA	1821000.	0.0085	2.037E+02
WYOMING	390000.	0.0018	4.363E+01
US TOTAL	214658000.		2.402E+04

A5. Estimation of food group fractions and marketing-to-consumption delay times

Table A6 lists USDA milk utilization data for 1975 (DOA76). A verbal estimate of the delay times between marketing and consumption of the dairy products was obtained from USDA personnel (DOA78). These times are also shown in Table A6. Based on a review of this data, it was decided that sufficient precision would be maintained in the calculations if two food groups were established. The food groups established are described in Table A7.

TABLE A6

Milk utilization for 1975 and estimated marketing-to-consumption times for various milk products (DOA78, DOA76)

Product	1975 Usage, Mlbs	Estimated Marketing-to-Consumption Time, d
Manufactured Products		
1. Creamery butter	19,603	14 d min., 30 d average
2. Cheese	24,080	30 d min, 1-6 mo. average
3. Cottage Cheese	1,049	1 week
4. Evaporated and dry whole milk	3,008	6 mo. average
5. Ice cream & other frozen dairy products	12,042	14 d min., 1-6 mo. average
6. Other manufactured products	821	
Fluid Products		
7. Sold by dealers & producers	51,400	1 day
8. Used for human consumption where produced	1,654	1 day
9. Residual	406	
	114,063	

TABLE A7
Food groups for population dose calculations

Food Group Description	Fraction for 1975 Usage	Estimated Marketing-to-Consumption Time, d
1. Includes creamery butter, cheese, ice cream, canned and condensed milk, dry milk, and other manufactured products (includes items 1, 2, 4, 5, & 6 for a total of 59,554 Mlbs)*	0.52	30 d
2. Includes cottage cheese, and all fluid milk products (includes items 3, 7, 8, & 9 for a total of 54,509 Mlbs)*	0.48	1 d

*See "items" in Table A6.

APPENDIX B

EPA Policy Statement on Relationship Between Radiation Dose and Effect

The need to assess environmental radiation impacts in terms of health effects has led EPA to establish a policy for relating radiation dose to health effects. The following policy statement was published in the Federal Register on July 9, 1976 (EPA76):

"The actions taken by the Environmental Protection Agency to protect public health and the environment require that the impacts of contaminants in the environment or released into the environment be prudently examined. When these contaminants are radioactive materials and ionizing radiation, the most important impacts are those ultimately affecting human health. Therefore the Agency believes that the public interest is best served by the Agency providing its best scientific estimates of such impacts in terms of potential ill health.

"To provide such estimates, it is necessary that judgments be made which relate the presence of ionizing radiation or radioactive materials in the environment, i.e., potential exposure, to the intake of radioactive materials in the body, to the absorption of energy from the ionizing radiation of different qualities, and finally to the potential effects on human health. In many situations, the levels of ionizing radiation or radioactive materials in the environment may be measured directly, but the determination of resultant radiation doses to humans and their susceptible tissues is generally derived from pathway and metabolic models and calculations of energy absorbed. It is also necessary to formulate the relationships between radiation dose and effects; relationships derived primarily from human epidemiological studies but also reflective of extensive research utilizing animals and other biological systems.

"Although much is known about radiation dose-effect relationships at high levels of dose, a great deal of uncertainty exists when high level dose-effect relationships are extrapolated to lower levels of dose, particularly when given at low dose rates. These uncertainties in the relationships between dose received and effect produced are recognized to relate, among many factors, to differences in quality and type of radiation, total dose, dose distribution, dose rate, and radiosensitivity, including repair mechanisms, sex, variations in age, organ, and state of health. These factors involve complex mechanisms of interaction among biological, chemical, and physical systems, the study of which is part of the continuing endeavor to acquire new scientific knowledge.

"Because of these many uncertainties, it is necessary to rely upon the considered judgments of experts on the biological effects of ionizing radiation. These findings are well-documented in publications by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the National Academy of Sciences (NAS), the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP), and have been used by the Agency in formulating a policy on relationship between radiation dose and effect.

"It is the present policy of the Environmental Protection Agency to assume a linear, nonthreshold relationship between the magnitude of the radiation dose received at environmental levels of exposure and ill health produced as a means to estimate the potential health impact of actions it takes in developing radiation protection as expressed in criteria, guides, or standards. This policy is adopted in conformity with the generally accepted assumption that there is some potential ill health attributable to any exposure to ionizing radiation and that the magnitude of this potential ill health is directly proportional to the magnitude of the dose received.

"In adopting this general policy, the Agency recognizes the inherent uncertainties that exist in estimating health impact at the low levels of exposure and exposure rates expected to be present in the environment due to human activities, and that at these levels, the actual health impact will not be distinguishable from natural occurrences of ill health, either statistically or in the forms of ill health present. Also, at these very low levels, meaningful epidemiological studies to prove or disprove this relationship are difficult, if not practically impossible, to conduct. However, whenever new information is forthcoming, this policy will be reviewed and updated as necessary.

"It is to be emphasized that this policy has been established for the purpose of estimating the potential human health impact of Agency actions regarding radiation protection, and that such estimates do not necessarily constitute identifiable health consequences. Further, the Agency implementation of this policy to estimate potential human health effects presupposes the premise that, for the same dose, potential radiation effects in other constituents of the biosphere will be no greater. It is generally accepted that such constituents are no more radiosensitive than humans. The Agency believes the policy to be a prudent one.

"In estimating potential health effects, it is important to recognize that the exposures to be usually experienced by the public will be annual doses that are small fractions of natural background radiation to, at most, a few times this level. Within the United States, the natural background radiation dose equivalent varies geographically between 40 and 300 mrem per year. Over such a relatively small range of dose, any deviations from dose-effect linearity would not be expected to significantly affect actions taken by the Agency, unless a dose-effect threshold exists.

"While the utilization of a linear, nonthreshold relationship is useful as a generally applicable policy for assessment of radiation effects, it is also EPA's policy in specific situations to utilize the best available detailed scientific knowledge in estimating health impact when such information is available for specific types of radiation, conditions of exposure, and recipients of the exposure. In such situations, estimates may or may not be based on the assumptions of linearity and a nonthreshold dose. In any case, the assumptions will be stated explicitly in any EPA radiation protection actions.

"The linear hypothesis by itself precludes the development of acceptable levels of risk based solely on health considerations. Therefore, in establishing radiation protection positions, the Agency will weigh not only the health impact, but also social, economic, and other considerations associated with the activities addressed."

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